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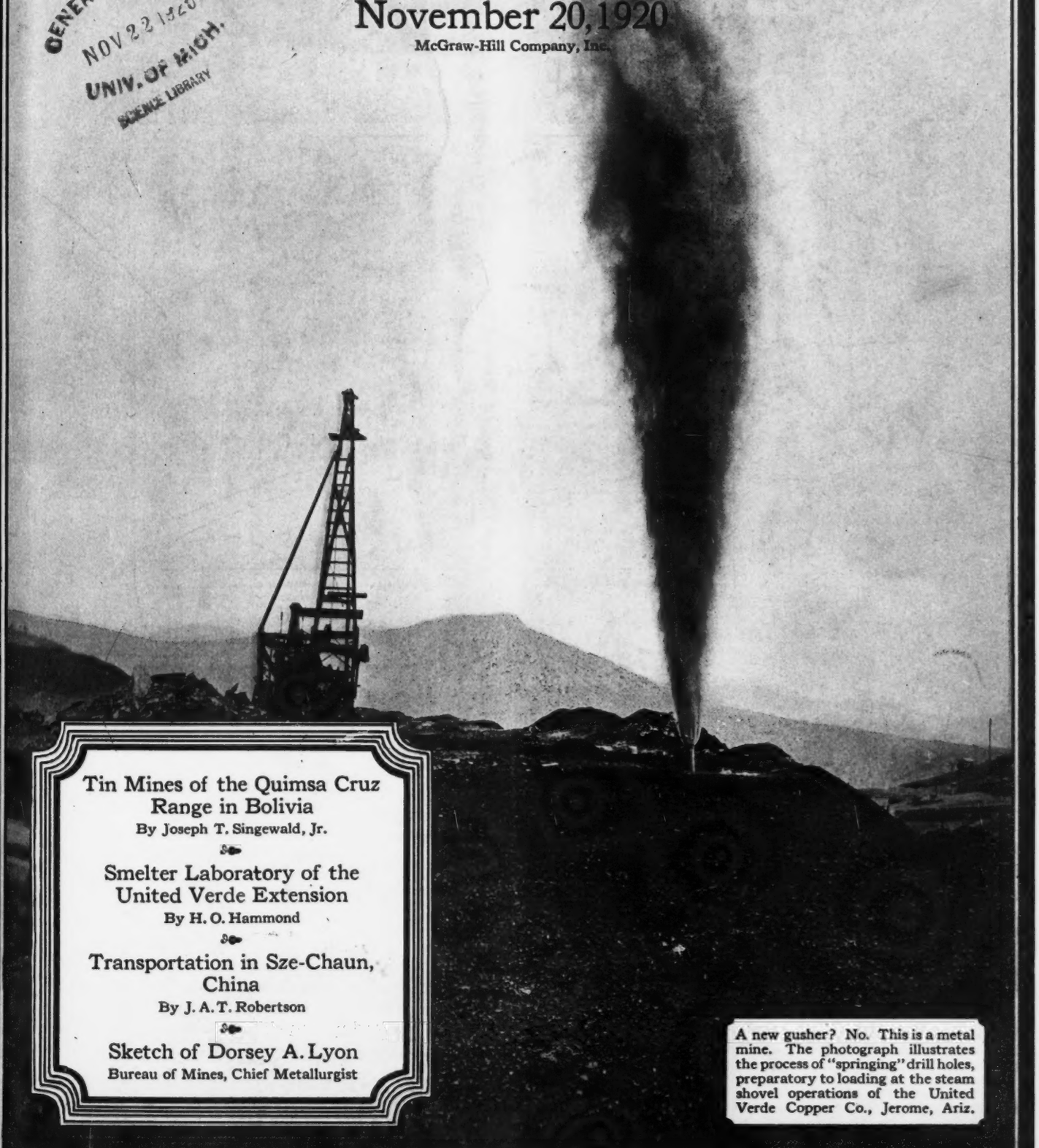

Tin Mines of the Quimsa Cruz Range in Bolivia
By Joseph T. Singewald, Jr.

Smelter Laboratory of the United Verde Extension
By H. O. Hammond

Transportation in Sze-Chaun, China
By J. A. T. Robertson

Sketch of Dorsey A. Lyon
Bureau of Mines, Chief Metallurgist

A new gusher? No. This is a metal mine. The photograph illustrates the process of "springing" drill holes, preparatory to loading at the steam shovel operations of the United Verde Copper Co., Jerome, Ariz.

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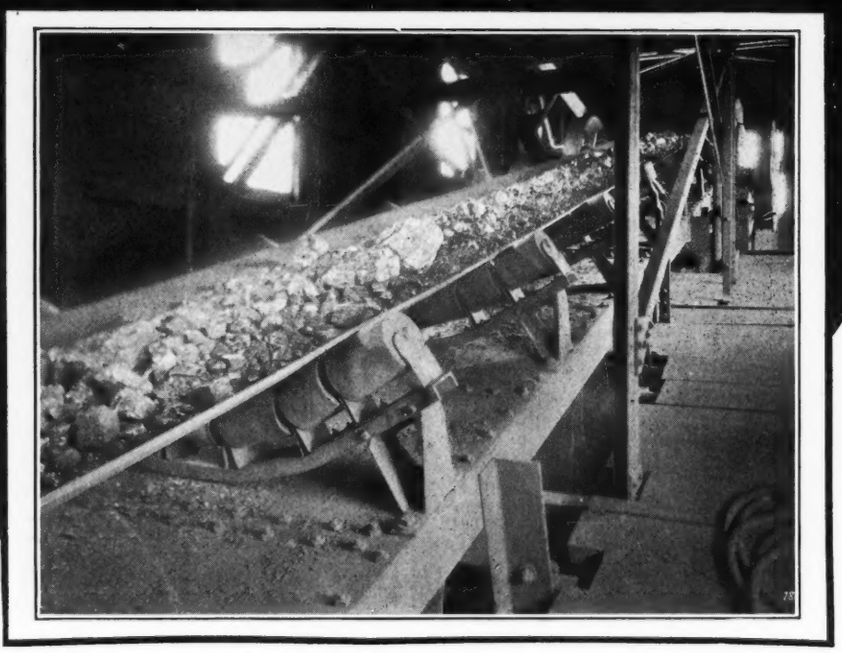

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Is the Mining Industry Classifiable Under Public Works?

ONE of the questions which will come up before the next Congress and the next Administration is the creation of a new Department of Public Works. Engineers as a whole are strongly behind this movement, believing that the establishment of such a department would be a concrete recognition of the dignity and importance of the engineering profession, and that it would make for greater co-ordination and efficiency in the government at Washington.

What should be our attitude on the subject? First, let us say, believing that public-spiritedness begins at home, that we are primarily interested in our own industry. This industry—the mining industry—has not been overburdened with champions; and when we speak for any special interest, it will be on behalf of our own.

Our most immediate care in the government organization, therefore, is for the two bureaus in the Interior Department that represent the mining industry, the Bureau of Mines and the Geological Survey. It is planned to incorporate these in the new Department of Public Works. Is the mining industry a branch of public works? What connection has it? Considering the subject analytically and honestly, we find the industry of mining remote from the problem of public works. Mining is a great and basic industry, producing raw materials: in this it is analogous to agriculture, the other great basic industry. Is it, then, proposed to merge the Department of Agriculture, which represents farming, into the Department of Public Works? Of course not. Who ever suggested such a thing? Why, then, incorporate the Bureau of Mines and the Geological Survey, which represent mining, into such a classification? Is the Bureau of Fisheries, which covers a third, though smaller, similar basic industry, going into the Department of Public Works? What a foolish question! Why, then, the Bureau of Mines?

The answer is very simple, and the reason is very stupid. A man educated to all the needs of the mining industry is called a mining engineer: but a man educated to all the needs of the agricultural industry is not called an agricultural engineer (although he might be, with great propriety) but an agriculturist. The fact that the educated miner is called an engineer created in his mind a supposititious nearest adherence to all engineers—to the electrical and mechanical and civil engineers—rather than to his own industry. Now, the electrical and mechanical and civil engineers are not concerned primarily in the production of raw material, but in construction: and it is they in whose field falls the whole subject of Public Works—construction of public buildings, irrigation, reclamation, dam building, government railroads, canals, river and harbor improvements, and the like.

If we were electrical or mechanical or civil engineers, we would probably be enthusiastic for the proposed Department of Public Works. We do not know; we cannot thus project our personality. But with that possibility in mind, we do not oppose the plan. Unless we greatly mistake, we have, as being concerned with the mining industry, no great interest in it; and the main reaction that we have is of the impending misfortune of having the bureaus representing the mining industry in the government swallowed up in it, under a ridiculously and palpably false classification. We of the mining industry would gain nothing from the change: it would be changing horses crossing a stream, and to a less reliable nag. Our position in the Interior Department is more genuine and distinctive than it would be in a Public Works Department. We are better off as we are. And if the two bureaus could be guided and co-ordinated under a single Assistant Secretary of the Interior, we should be as well off as we can perhaps hope to be, unless we could secure the creation of a special Department of Mines.

The Bureau of Mines, we believe, has no activities which fall under the head of Public Works. The Geological Survey has had and has such activities, but they are collateral, or are homeless orphans that are temporarily sheltered by the Survey, and do not cover the mining industry; and we take it that the economic justification of the Geological Survey is first and last its benefit to the mineral industry. Such an orphan is the Super-Power Survey—and if a Department of Public Works should be created the Super-Power Survey should be transferred to it.

The reclamation work of the government was likewise started under the Geological Survey, but was pruned away from it in recognition of its essentially alien character. There is even no reason why the construction of the base maps of the Geological Survey should not be taken over by a Public Works Department if one were created. It belongs there: the Geological Survey has to make these maps because it finds no base maps ready for its use. But in perceiving the proper classification of some of the collateral jobs of the Geological Survey as belonging to Public Works, let us not make the blunder of grouping the mining industry under that category!

The Broken Hills Silver Corporation

THE Broken Hills Silver Corporation of Nevada, which was the subject of an article in our issue of Nov. 13, is sending out monthly mine reports for the purpose of selling stock. These are signed by Mr. Arthur Perry Thompson as consulting geologist and engineer.

In the report for October we note that the first car of ore has been shipped—thirty-five tons averaging $216 a ton. Mr. Thompson states quite frankly and conspicuously that "This shipment represents results of *high-grading operations*, for a period of twenty-five

days, in the rich stopes," etc. "Stopes were started along the vein at points where high-grade ore was most plentiful." "The extraction of high-grade ore . . . has required constant care in sorting the high-grade product from a much greater volume of low-grade, *milling ore generally comprising the bulk of the vein.*"

"From one to two tons of high-grade ore are now mined daily from the Belmont Incline stopes."

With these thoroughly honest and tempered facts, Mr. Thompson embarks on that most difficult of all things, a forecast: "It is not too much to expect that, with the complete development of the cross-vein at the 150-ft. level *and the downward continuation of rich ore* such as is being mined on the 75-ft. level, a production of ten tons or more per day of $240 ore, or at the rate of $72,000 per month, *may be* attained. *Favorable developments on the 150-ft. level* will even increase these figures."

Here, then, is where the consulting geologist and engineer gets off the pathways of conservatism. *If* the cross-vein development is favorable; *if* the rich ore, *if* developed further on the 75-ft. level, goes down, we *may* be able to high-grade ten tons a day, picking the eyes out of the milling-ore vein.

If wishes were horses, beggars might ride. The experienced mining engineer will not detect evidence of anything that looks like a mine in reading this report. Granted that this consummation is reached, that ten tons of $240 ore—where does Mr. Thompson get that figure of $240?—is mined out, how much will the total cost of that ore be, with all the sinking, crosscutting, and drifting necessary?

Mr. C. H. McIntosh, president of the Fidelity Finance & Funding Co. (which is the George Graham Rice organization), solves the question of cost and profit easily in a circular letter offering stock for sale. Quoting Mr. Thompson's report, as above, Mr. McIntosh says: "It *may be estimated* that net annual profits on a gross production at the rate of $72,000 a month would be at least $600,000 a year. This would be equal to 200 per cent per annum on the par of the entire capitalization of the Broken Hills Silver Corporation."

Therefore, "we feel sure you will agree with us that the speculation now inherent in the stock at such a low price as 13c. a share is extraordinary."

We do most heartily agree: it is a most extraordinary speculation to invest at 13c. a share, on the evidence of this report: so extraordinary that we should call it a thousand-to-one shot that we should never see our 13c. again. Any man who buys mining stock on the strength of thirty-five tons of ore, high-graded from rich chlorides and sulphides near the surface, belongs manifestly to the classification concerning which an erstwhile contemporary sagely declared that one was born every minute.

Mr. Thompson's report contains no misstatement, although his forecasts are optimistic. But his report is evidently intended to play into the game of George Graham Rice, McIntosh, and others, to unload the stock at a profit. It will also be observed that Mr. McIntosh makes no false statement—he quotes certain assumptions only, and then remarks that the stock is a speculation.

So we submit to Mr. Thompson, as a geologist and engineer, that his position in co-operating with a plan to sell stock in a prospect, on the glittering figures of unwarranted assumptions, is not professionally an ethical one.

Aiding Coal Conservation

THE effect in this country of the British coal strike, although temporary, was significant and emphasizes the necessity for the careful consideration of our own coal problem. Extended limitation of coal production abroad naturally places a greater demand on our export tonnage, with the result that the competition forces higher domestic prices, and we face a condition which, judged at least by our household standards, is highly undesirable.

According to figures given by the *Statist*, the aggregate world's shortage of coal in the coming year, without reckoning the British shutdown, will be about 72,000,000 tons. The present normal production of the United States is stated by this same authority to be 30,000,000 tons in excess of its consumption of 600,000,000 tons. Although it is gratifying to know that we are credited with being on the safe side of the ledger, statistics are not always to be taken at their face value, and other factors, such as transportation, labor conditions, and a possible increase in foreign demand, are to be considered.

In some quarters the appointment of a National Coal Controller and the prompt limitation of coal exports are advocated; others are of the opinion that we should "keep our coal at home." The latter idea we reject on general principles, believing that the acceptance of the plan for "prompt limitation" is more in accordance with American ideals. The foregoing suggestions deserve immediate consideration, and undoubtedly offer a solution of the coal problem as we have it today. However, it is not with legislative matters alone that coal consumers must concern themselves, for such measures can relieve the situation only in part. The immediate need is for the conservation of what we already have, and it is to that effort that industry must bend its energy.

In an address recently delivered before the American Iron and Steel Institute, Mr. George Otis Smith characterized coal as "the staff of life to the industrial world," and demonstrated the need for fuel economy in every branch of industry. It is a notable fact, as pointed out by Mr. Smith, that the motors used in the steel industry aggregate nearly one-third of the power of all the motors installed in the United States. Such a statement makes pertinent the question, To what extent can electric power be further utilized in other undertakings?

The mining industry has already successfully effected the substitution of electric power in many instances, and the central power station idea is gaining ground. There remains, however, much to be done in this direction. For example, we still have, in some sections, the small hand-fired boiler, wasteful in the use of more than its rightful share of coal, which stands as an example of needless extravagance and represents a serious drain upon the coal production of the country.

Perhaps it is not generally known that 30 per cent of the fuel burned in the ordinary mine boiler plant is absolutely wasted. But such is the fact, and this waste does not include the losses in power that are incurred through leaks and defective connections. Furthermore, there is the low average load, caused by intermittent hoisting and other operations, to which is due the real plant loss. With power furnished by a central steam or electric plant, such a loss would be compensated, and not only a saving effected in coal but in plant operation as well.

A Little Knowledge Is Dangerous

IN OUR news columns we gave a short account of a mine accident which took place on Sept. 30 in the mine of the Calaveras Copper Co., at Copperopolis, Cal. The successive stages, according to an accurate account, were, first, a fire in the mine buildings in the near vicinity of the Union shaft; second, the spread of the fire to the shaft collar; third, the withdrawal of all of the men from the mine. The fire spread to the upper part of the shaft and extended downward a sufficient distance to fill the mine with gas. In the morning an ex-soldier wearing an army gas mask attempted to reach the 1,200 level of the Discovery shaft, the main working shaft of the mine. His purpose was to open an air valve. This man did not return, and two men, wearing ordinary dust respirators, started for the 1,200 level to rescue the first. One of these men got back alive, but suffering from the effects of the gas.

In a previous editorial we have pointed out the limitations of the army gas mask. It will not remove carbon monoxide gas. Carbon monoxide gas exists in greater or less amount in all gases resulting from mine fires. Only a person who has had experience with mine fires understands the rapidity with which the air in a mine is polluted with poisonous gases resulting from the more or less incomplete combustion which is characteristic of all mine fires. Carbon monoxide is extremely toxic in small amounts. It is quickly fatal in large quantities. The only safe apparatus is the oxygen breathing apparatus, and this is safe only when in proper condition, with an adequate supply of oxygen, and in the hands of experienced persons.

We cannot point out too emphatically the imperative necessity that all managers and superintendents of mines prohibit the wearing of army gas masks, respirators, and all other apparatus except the oxygen breathing apparatus where mines filled with gases resulting from a fire are to be entered.

Marketing Non-Metallic Minerals

METAL miners have a superior advantage in marketing their ores. Many custom smelters are willing to take odd lots of ore, even though they are sometimes pitifully small. Nevertheless, the custom smelter is anxious to get long-term contracts, as the fulfillment of such contracts tends to stabilize his business to a marked degree. As a rule he is sympathetic with the small producer and finds it good business to help him.

The marketing of non-metallic minerals, on the other hand, with some exceptions, is not so easy for the small or occasional producer. Their value rests to a considerable degree in the control of the market that has been established either for the minerals or for the products manufactured therefrom. Manufacturers and marketers of such products are primarily interested in securing steady flows of raw mineral, as the demand for their products is often severely restricted. Thus, long-term contracts are in vogue. Three years or even five years is not uncommon as a length of contract.

Again, processes of manufacture are not easily adjusted to take care of variations in the quality of raw materials. An established operation producing a raw mineral of uniform quality is in an excellent position to dispose of its product, and usually does so on the basis of a contract. The discoverer of a new deposit may find the market completely closed, either because it is dubious whether he can supply the mineral continuously or for the reason that his prospective customers fear a variation in quality. He may know that the mineral is selling for a certain price, but it may require persistent effort for him to dispose of his fifty-ton lot. To get into a more favorable position—granting that other factors, such as proximity to markets, transportation facilities, labor supply and general operating conditions, are not adverse—he must develop his deposit sufficiently to sustain a steady production for a period of years. He is then in a position to bid on contracts or has the alternative of entering into the manufacture and sale of the products from his mineral. The latter involves a manufacturing plant and a sales organization. It is obvious that a business of this kind requires time for its development, as it usually competes with concerns already established.

The important point to the discoverer of a non-metallic mineral deposit is the control of sufficient capital fully to develop the tonnage possibilities of his deposit as well as to establish thoroughly its quality. Even then he may be unable to break into the existing market, on account of the presence of long-term contracts. There is the possibility of doing business through the principals owning a contract, but, needless to say, this can be done only at the sacrifice of some of the profits. It may thus be necessary for him to wait for more favorable conditions or to embark into the manufacturing business himself. It is worthy of note that there are mineral brokers or agents who deal in odd lots of certain non-metallic minerals. By persistent search the small producer can get in touch with them, and may sell a small lot to advantage. Certain chemical manufacturing companies are also interested at intervals in different non-metallic minerals, and correspondence may be effective in leading up to a sale.

Specie Payments

THE Commercial Trust Co. of New York City recently refused the request of a depositor for a ten-dollar gold piece, saying that the company was not paying out any gold, but was keeping what it had in reserve. The Corn Exchange Bank, on the other hand, acceded to the request of a depositor for a twenty-dollar gold piece.

What is the attitude of your bank, friend reader? If gold is so scarce with the bankers, should they not assist in increasing the production? Yet their association refuses to consider a large production necessary.

If a gold reserve is good for a bank, is it not good for its clients? If the banks regard gold as more precious than paper, do they not acknowledge the cheaper value of the currency which they do hand over the counter?

Our Market Reviews

AMONG the various features which have been introduced into *Engineering and Mining Journal* during 1920, one of the most appreciated is our reviews of metal markets and prices. As an example, our page discussion on the copper situation in our issue of Oct. 30 was copied, with appropriate credit, either in full or in part, by the *New York Commercial*, the *New York Journal of Commerce*, and the *American Metal Market*. Shorter summaries of our copper market news in the same issue were made by the *New York Tribune* and the *New York Post*, among other papers.

WHAT OTHERS THINK

A Desperate American

Your editorial discussions of economic and political matters are very sane and interesting. Recent issues have touched on the immigration question as well as the need for the assimilation of foreign immigrants. It must be conceded that in normal times the supply of native labor is insufficient to perform the necessary work of the country and therefore it is necessary to make up the deficit from foreign countries. In the earlier times our immigrants came mostly from the British Islands, Scandinavia, and Germany, and, due to the enormous areas of unsettled lands available for free appropriation, and also to a natural taste for rural life, these newcomers soon scattered and became an integral part of their communities and of the nation.

Latterly this increment to our society has been chiefly made up of Slavs and southeastern Europeans. They, as well as the newcomers from the north European countries, have been drawn from a lower class of society than formerly. The conditions they meet on arrival here are very different from those that obtained twenty years ago. Nearly all go into industrial communities and form colonies with others of their own race. From a selfish standpoint, the fact that they form colonies or the economic conditions in which they live is immaterial (most of us have arrived at the point of exasperation, where we do not care what their moral, physical, or spiritual condition may be), but in addition to the fact that they form colonies is the more alarming fact that they form political groups. Our office seekers, for the most part business failures and self-seekers or themselves foreign born, pander to these groups and combine them all against the native-born American.

Those of us who live in industrial centers are ruled by a wild ignorant mob of half-matured foreigners, the scum of their own countries. In this community the vote of the American is scattered and unorganized, and he has no voice in the conduct of the local government. A roster of the office holders, both elective and appointive, will show 90 per cent of one foreign race. The people of this race that now come here are ignorant, bigoted, intolerant, and lawless. Revolution is a common word in their mouths. In the coming election it is almost a foregone conclusion that the most vile, radical, and anarchistic element in the whole country is about to be voted into power in the county, if not in the whole state. It is commonly stated that an American has no chance here in a controversy or in court against a foreign-born citizen. When the latter gets into trouble his political broker gets on the job immediately and pulls the wires to his own, and all other, foreign potentates in power. This discrimination extends to the public schools and to a great extent to the salaried positions in commercial life.

Such conditions are intolerable to people of decent upbringing, and if the Bolsheviki ticket is elected it will probably mean that all of us who can do so will leave this splendid prostrate carcass for the jackals to fight over, or else that we must combine against our elected officers and their rabble of foreign vermin and protect our families and property by violence.

There seems to be no immediate remedy for such a condition, but there is a very potent remedy against its recurrence. Let us have needful immigration but restrict the franchise. No foreign-born resident should ever be given a vote, no matter what his length of residence, unless he distinguishes himself in some line of endeavor. In this way citizenship would be a prize, and all desirable foreigners would work and conduct themselves to the end that they might receive such a reward.

It is not important whether the foreigners are assimilated or not if we can outvote them and control our own institutions.

I would like to see this matter advocated in your editorial page. AN AMERICAN.

Butte, Montana.

Mining Opportunities in Siberia

In the article entitled "The Mining Opportunities in Siberia," appearing in the issue of *Engineering and Mining Journal* of Aug. 14, 1920, the suggestion appears to be made that mining in Siberia was formerly conducted on "concessions," particularly where foreigners were concerned. Speaking for the metal-mining industry, I am not aware that metalliferous land concessions have ever been granted to foreigners in Siberia, with possibly one exception. In certain areas, namely south Altai, and in the Nerchinsk district, Cabinet Lands have been leased to foreigners through the medium of Russian companies specially formed for the purpose. Concessions so leased would not have totaled 1 per cent as compared with the mineral lands opened for location by private persons in Siberia during the early part of the nineteenth century.

The Russian law allowing of the locating and patenting of mineral lands by individuals is a just and fair one, based presumably on the Spanish law. It is not saddled by the law of the apex. In 1898 and 1899 I located and patented in my own name several claims for gold dredging on the Serebranka Creek, Perm Government, at nominal expense and with no particular difficulty. Any Siberian or Russian peasant possessing the ordinary civil rights could have done the same.

The gold-mining enterprises with which I have been associated in Siberia have been on mineral territory to which titles were held by the law of claims regularly staked, surveyed, and patented. In the principal east Siberian goldfields the larger enterprises were initiated by private individuals or small groups. These men, Siberian merchants and miners, were no more assisted by government concessions or subsidies than is the American metal miner in the Western States or in Alaska. Claims located in the "Northern Taigá" district of Yenesei, and in the Olekma district of the Lena drainage, in the 40's are still held and operated under the laws of the Mining Department, or at least were worked up to 1916.

It is doubtful if Sibiryakof, Trapeznikof, Bazanof, Gromof, Bazilevsky, and others of the fine old pioneers of the Yenesei and Vitim gold districts ever heard of "concessions." They merely took advantage of the Mining Law applicable to the public lands of Siberia.

Your correspondent, Mr. Narodny, and his authority, Mr. Leonoff, appear to be correct in their contention that "co-operation" appeals to the Siberian mind. Most of the ventures of groups of Siberian miners were denominated "partnerships," the Russian word being built up from the root "tovarish," meaning a pal or comrade. These "partnerships" were not only recognized by the Mining Law, but in some cases their shares were dealt in on the St. Petersburg stock exchange. These associations had an interesting prototype in the groups of Irkutsk merchants of the eighteenth century, which fitted out ships at Okhotsk and Petropavlovsk for the purpose of obtaining furs on the Alaska coast. The furs were brought back overland from the Pacific ports to Irkutsk, and then sent to Kiakhta, on the Mongolian frontier, where they were sold to Chinese merchants.

Thus it would appear that the apologists responsible for the article, in the instance of "concessions," attack a position which is practically non-existent, and as regards "co-operation" they at considerable length defend an axiom which is not opposed. At least this criticism applies so far as their remarks concern the mining industry.

C. W. PURINGTON

Hakodate, Japan.

Amalgamation in Tube Mills

Having recently seen considerable discussion concerning amalgamation in tube mills, the following may be of interest:

Since the use of cyanidation and flotation has become so successful, amalgamation has gradually been placed in the discard. However, there are still many who advocate it. In a great many cases even now amalgamation should undoubtedly be used. In general, if it is possible to get an extraction of 60 per cent or more it may be best to consider this method. This is particularly true if the gold is contained in coarse particles.

It is often claimed that amalgamation is not possible because the gold is "rusty." Rusty gold can be amalgamated if given the proper treatment. Rusty gold is gold coated with an oxide, not alloyed with another metal, as I understand it. Such gold may be amalgamated if given a good scouring and immediately exposed to quick [quicksilver] under proper conditions.

At the Gold Hill & Iowa Mines, Quartzburg, Idaho, it has been definitely proved that amalgamation can be successfully done in tube mills. I think, also, that the days of the stamp mill are numbered. There are certain factors, however, that should be brought to the attention of the tube mill amalgamator.

The ore at this plant is an antimonial gold-bearing quartz contained in a rhyolite porphyry gangue. Small stringers of quartz are interwoven throughout the ground mass. The ore carries very little zinc, no lead, no copper, very little silver, and from 2 to 3 per cent concentrates, which are principally iron pyrites. The antimony is less than one-tenth of 1 per cent. It is soft and easily crushed. Panning tests show very little free gold unless the particles are first rubbed briskly in a pan, preferably with an iron rod. The antimony is always a sure sign of good ore in this property.

Former treatment with stamps, with inside amalgamation, never gave an extraction to exceed 55 per cent. Fine screens were used, but the resulting amalgam was composed of the coarser particles, whereas the fine gold generally went into the tailings. The gold is often coarse, but there is always some fine. When examined under the glass, or sometimes even with the unaided eye, it will be noted that the gold is coated with a film of antimony or with a combination of antimony and sulphur. This coating is glassy, hard, and brittle.

In treating this ore for the last ten years, during which time we have handled a large tonnage, certain points have been brought to our attention forcefully. First, and important, is the fact that the gold *must be scoured*. This should not be confused with hammered. It was noted that the old arrastres gave good extraction on these ores. We have therefore, in a way, tried to imitate these old-fashioned machines. This has led to the use of the tube mill run on arrastre schedule. By this I mean run at such a speed that the charge will slide. We have found the Hardinge conical mill especially adapted to this class of work. It is possible to crush over 175 tons per day through an eight-foot mill when used as a secondary crusher and amalgamator. We pay special attention to feeding a certain quantity of grits into this mill with the charge. These grits are simply pieces of hard ore which are allowed to by-pass the ball mill which is used as a primary crusher ahead of the Hardinge mill. They are pieces of ore of from ½ to 1¼ in.

The flow sheet of the mill (See Fig. 1) is: Grizzly, Blake crusher set to two inches, rolls set to ¼ in., cylindrical tube mill 5 x 4, lined with Komata lining and using Adamantine pebbles, which come from Sioux City, Iowa. This mill discharges a product of about 8 or 10 mesh into the Hardinge mill, which also has the same lining and uses the same charge, with the exception that the pebbles are smaller. Both tube mills are run at a speed that allows the charge to slide, the Hardinge being run at 18 r.p.m. only. Quick is fed into

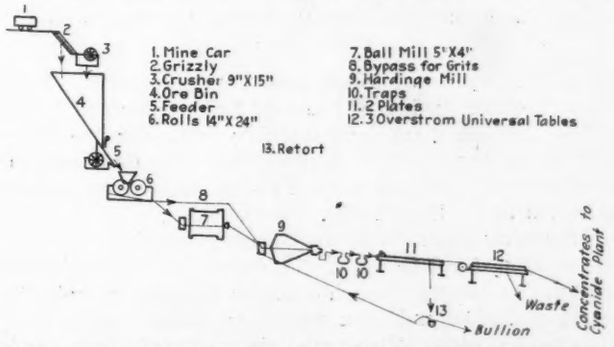


FIG. 1. MILL FLOW SHEET. GOLD HILL & IOWA MINES CO.

the scoop of the Hardinge. No amalgamation is attempted in the cylindical mill, and that is considered as a crusher only.

The discharge from the Hardinge is through an amalgamator bolted on the discharge trunnion. (See Fig. 2.) A brief description of this amalgamator, which is a modification of the regular Hardinge amalgamator furnished with the mill, is as follows:

A copper plate *(A)*, which the millmen call the "stovepipe," is put into the discharge end. This plate is bolted by three small bolts that allow it to be easily taken out for cleaning. When the bolt is out it is possible to spring the plate enough to allow its easy removal. This is accomplished by making it like a stove-

pipe before riveting and making the bolt that acts as one of the bolts that hold it on pass through both thicknesses of copper. Also, inside this so-called stovepipe we use four or five riffles of about ¾ in. height. These are placed parallel to the axis of the machine. We use no screen. The stovepipe passes back four or five inches into the amalgamator. Amalgam forms at *C*, also at *X* and *Y*. Some is found also inside the tube at *A* and back of the riffles, *B*.

From the amalgamator the pulp runs through traps and then over stationary plates as in the ordinary stamp mill. There is nothing special concerning the plate amalgam excepting that we run the plates comparatively hard and use Sapolio to dress the plates every eight hours. The method of using this is to give the same treatment as in cleaning a window, but allowing the white lather to remain until the water is running over the plate and then finishing with a whisk broom used so that the brushing is done lengthwise of the plate. This prevents the fine concentrates from sticking to the plates. A safety box is used when dressing the plates to catch any loose amalgam that may escape.

From the plates the pulp passes over Overstrom Universal concentrating tables, where a small portion of

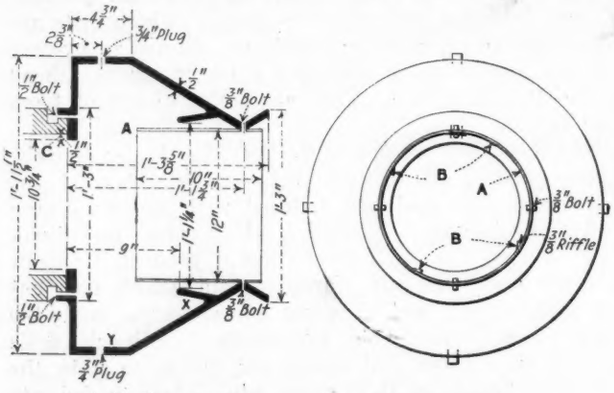


FIG. 2. HARDINGE AMALGAMATOR AT THE GOLD HILL MILL

the sands is allowed to go into the concentrate. This allows a closer saving of the gold to be made and helps in the cyanide plant by supplying grits for the tube mill where fine grinding is practiced. Excellent results are shown in the cyanide plant on this concentrate after agitation in Pachuca tanks.

Returning again to amalgamation, quick is fed into the scoop of the Hardinge. This quick is "doped" with sodium, by adding enough metallic sodium to make it amalgamate the end of a small file, then diluting it a little with quick. This quick is prepared daily, and must be fresh.

Frequent pannings of the feed going into the Hardinge serve as a guide to the quick feed. The condition of the head plates acts as a direct indicator of the feed. When the plate is hard and white more quick is needed, which should be applied by more frequent feeding instead of feeding in large doses. Should the plates be too dry free gold will show on the concentrators.

The pulp is run much thinner for amalgamation than for ordinary fine grinding. We have tried running the mill in closed circuit, but got poor results. A spray of water shot into the discharge end of the mill at the point where the pebble charge comes to the trunnion will help the capacity.

The shape of the conical mill is especially adapted for amalgamation, as classification is always going on. The particles of gold have to climb the incline before being discharged. This gives a chance for them to receive the grinding action similar to the arrastre. They come into contact with the quick in the amalgamator when they are free from oxidation and bright. The quick fed into the mill also finds its way up the incline until it reaches the point of the cone where action is less violent, and the result is that a pasty amalgam is formed, which goes into the larger opening of the amalgamator, where it is trapped until ready to be cleaned up. This pasty amalgam catches fine gold or other amalgam that tries to get by.

One of the most interesting points noticed in this practice is the fact that when steel balls were tried for amalgamating the results were unsatisfactory. Amalgamation was then a failure. Investigation showed the following conditions: If a particle of gold is laid on a polished anvil and hit with a smooth-faced hammer, and the resulting particle is then put into a bath of quick, it will not amalgamate. Again, if a similar particle of gold was laid on a piece of grindstone and rubbed with another rock, the surface of the gold was brightened and roughed so that amalgamation was instantaneous. In running with steel balls and steel liners the gold discharged was hammered and small disks were discharged which would not amalgamate under any condition that we were able to produce. Careful examination under a strong glass showed that the particles had a hard shell which prevented direct action of the quick on the gold.

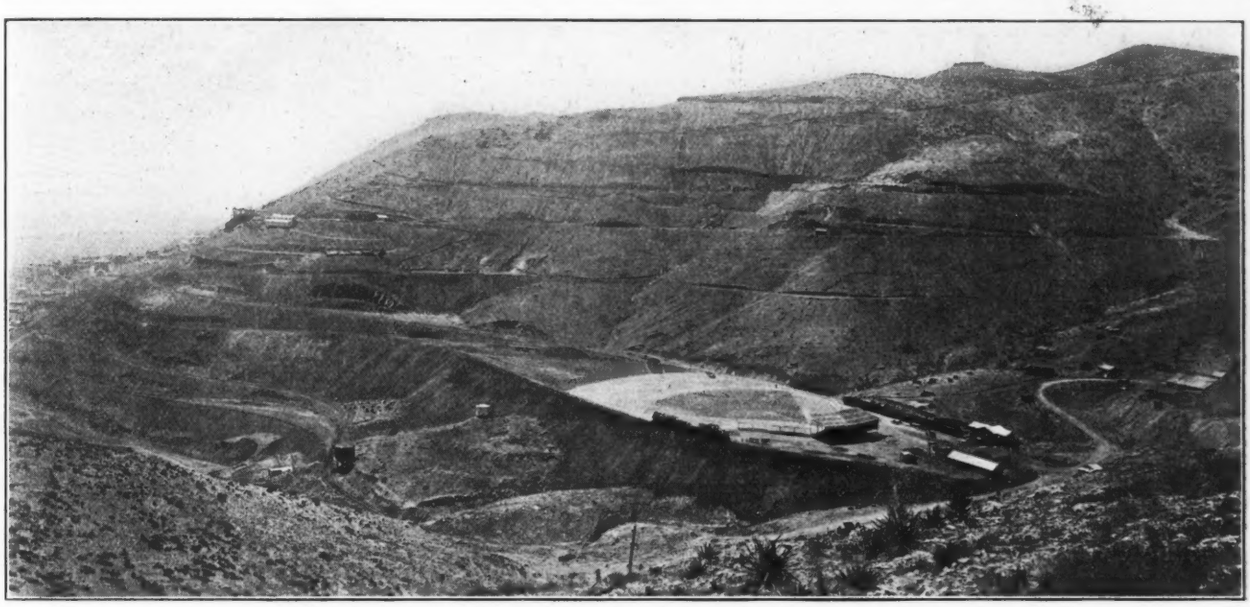
In practice now we use Jasper Stone Co. pebbles and use lifter bars in the Hardinge. A large portion of the amalgam is taken from the back of these bars. We found after trying speeds of from 29 to 18 r.p.m. that we got best results with the slower speed, 18 r.p.m.

Objection has been made that it is hard to clean up a system such as we suggest. We find that we can make a thorough cleanup every month within three or four hours. The running time of the mill will exceed 90 per cent. A more thorough cleanup is made when replacing the lining, which is generally once a year. Very little amalgam remains in the charge after it is run down. Comparatively little amalgam remains behind the lining plates, as these are backed by one-inch boards, which act as a pad and allow little to get behind. The door is opened once a month and amalgam is scraped from the cracks, but the charge is not removed, as the mill can be rocked enough to allow practically all the inside to be reached. Part of the coarser pebbles are removed to make more room during this operation. Nothing is done with the sands during monthly cleanups, but when relining, the sand charge is fed into the scoop after putting in new liners. An extraction of better than 85 per cent is made by these methods, which I think will compare favorably in cost with any cyanide or flotation process.

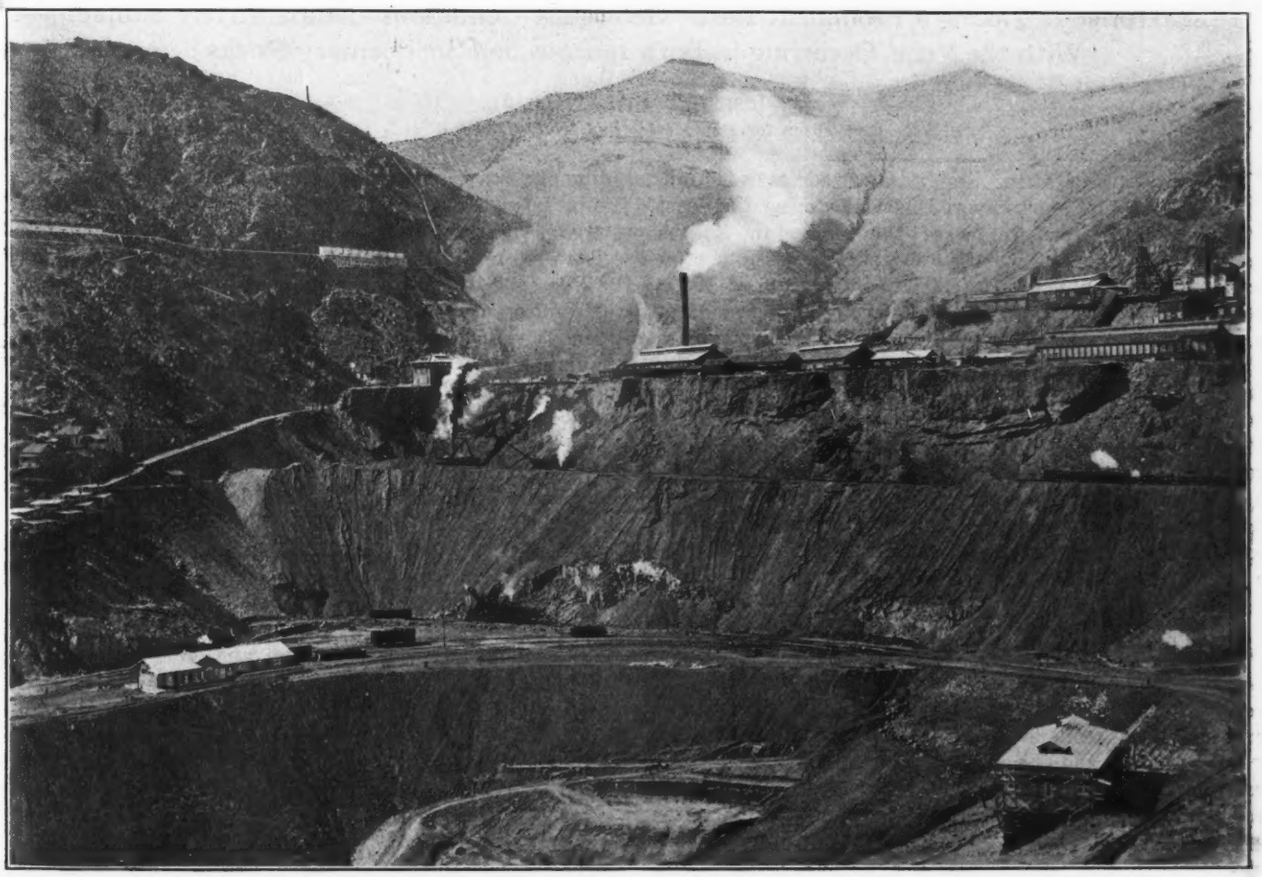
Boiled down, our experience has shown that the gold should be scoured and not hammered; that immediate union with the quick is essential before oxidation takes place; that pasty amalgam should be thrown into a quiet place away from too violent action of the pulp; that quick must be kept active; that a thin pulp acts better for amalgamation; and that one must grind lots of good ore to make a living these days, when gold values are placed below those of spuds and candy.

Quartzburg, Idaho. E. E. CARTER,
Manager Gold Hill Mines.

The United Verde Copper Co., Jerome, Ariz.



GENERAL VIEW OF SWITCHBACK CONSTRUCTION, UNITED VERDE MINE
To the lower right of the picture can be seen the recently constructed baseball grounds, the park being entirely on filled ground made from stripping waste.



GENERAL VIEW OF STEAM-SHOVEL OPERATIONS AT UNITED VERDE, SHOWING SHOVELS WORKING ON 160-FT. AND 300-FT. LEVELS

JACHACUNOCOLLO, OR THE GREAT SNOW MOUNTAIN, SEEN FROM THE CHOJÑACOTA MINE. A TYPICAL VIEW OF THE QUIMSA CRUZ RANGE

Tin Mines of the Quimsa Cruz Range In Bolivia*

The Geology and Mine Workings of a Promising Area, in the Development of Which American Enterprise Is Taking a Prominent Part—Geological Conditions Comparatively Simple, With the Veins Occurring in Both Igneous and Sedimentary Rocks

BY JOSEPH T. SINGEWALD, JR.
Written for *Engineering and Mining Journal*

THE Quimsa Cruz Range is a series of high, glacier, and snow-covered peaks forming the crest of the eastern range of the Andes in Bolivia between La Paz and Oruro (see sketch on following page). It is bounded on the north by the gorge of La Paz River, where it cuts its way through the Andes at an elevation of 6,500 ft., and on the south by a pass 15,000 ft. in elevation between it and the less lofty Santa Vela Cruz Mountains. Between these two passes is an almost uninterrupted series of icy peaks, many of them exceeding 20,000 ft. in elevation. So rugged is the topography and so rigorous the climate that, though highly mineralized, the region is one of the least developed and least explored of the Bolivian tin-bearing areas. It is now, however, attracting much attention, and promises to become one of the leading tin-mining regions of Bolivia.

GEOLOGY AND MINES OF THE RANGE

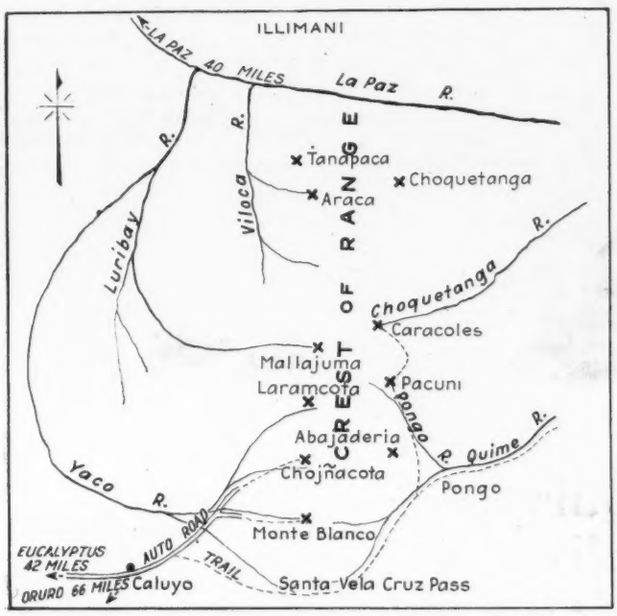
In its general features the geology of the range is relatively simple. The crest and the upper part of the eastern slopes consist of granite. The whole of the western slopes and the lower part of the eastern slopes are made up of Silurian and Lower Devonian highly metamorphosed shales, with intercalations of quartzites and sandstones. The range has been subjected to considerable tectonic disturbances, and both granite and sediments have been highly fractured. Many of the fractures are the seat of tin veins and occasionally of tungsten veins.

The ores are of the normal tin type, characterized by the presence of cassiterite and, in some of the veins, wolframite, as the only ore minerals of value. The argentiferous sulphides of the more complex type of Bolivian silver-tin ores are lacking and there is little or no bismuth. The pneumatolytic minerals are represented by an abundance of tourmaline.

The active mines on the west side of the range are, from north to south, the Tanapaca, Araca, Chojñacota, and Monte Blanco; on the east side the Caracoles and Pacuni. Less important mines are the Mallajuma, Laramcota, Choquetanga, and Abajaderia. The Tanapaca and Araca mines are sixty-six miles from La Paz by a trail that follows La Paz River. The other mines have their outlet by way of Caluyo to Eucalyptus, a station on the Antofagasta and Bolivia railway between La Paz and Oruro. Between Eucalyptus and Caluyo, a distance of forty-two miles across the high plateau, is an automobile road, which continues beyond nearly to Monte Blanco and Chojñacota. Mines on the east side of the range have their outlet through the Santa Vela Cruz pass to Caluyo. This trail has been rather poor, but since the Guggenheim Brothers have entered that region they have greatly improved the trail and are constructing a road to Caracoles.

*George Huntington Williams Memorial Publication No. 2.

The Empresa Minera Tanapaca represents a consolidation of two small mines which belonged to Louis Pando and Hugo Zalles and is now under option to the International Mining Co., which is closely identified with W. R. Grace & Co. Two veins, the Potosí and the Alliança, are being worked. They lie on the slopes of the first group of peaks west of the main ridge of the Choquetanga Range. The latter peaks consist of granite, and, judging by the huge boulders that have been



SKETCH OF QUIMSA CRUZ REGION, BOLIVIA

carried down from them, the rock is a biotite-tourmaline granite porphyry. The country rock of the Tanapaca mine is hard, highly metamorphosed shale or slate with interbedded quartzite.

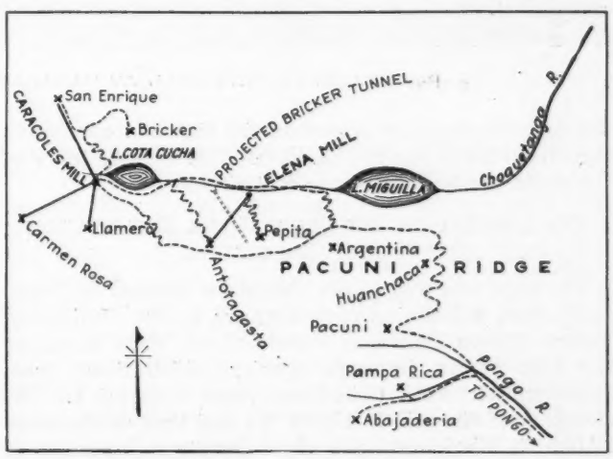
The Potosí vein has a width of from 18 in. to 3 ft. The filling consists of soft, iron-stained material, or "llampu," with an average tin content of 4 to 5 per cent. The ore is treated in the Tarujhumaña mill, which is equipped with two water-driven arrastres and a series of buddles for each. The tailings of this mill carry 2 per cent tin. The production is at the rate of twelve tons of concentrates monthly. The elevation of the mine and mill is nearly 15,000 ft.

A mile south of the workings on the Potosí vein are those on the Alliança. The vein filling consists chiefly of cassiterite, quartz, and iron hydroxides, and some pyrite in the lower part of the workings. The orebody has a width of as much as 2½ ft. and an average tin content of 10 per cent. It follows a contact of slate and quartzite, with the former on the hanging wall. Often the hanging wall part of the vein consist of mashed shale with many quartz stringers. On the foot wall is a band of solid quartz. The relative importance of these two members varies from point to point, and at many places one or the other is entirely lacking. A short distance south of the Alliança vein is the Mocoya mill, in which the ore is treated. The mill is equipped with a Chilean mill, jigs, Ferrari tables, and buddles. Scarcity of water in the winter months prevents the utilization of part of the machinery in that season, and the ore is then sent direct to the buddles from the Chilean mill. The production is ten to twelve tons of concentrates per month.

The property of the Empresa de Estaño de Araca is about three miles south of the Tanapaca mine near the head of a deep valley, immediately beneath the snow and glacier-covered Choquetanga peaks. The mill and administration buildings are situated at an elevation of about 13,500 ft., in a branch of the Viloca River, and the mines lie 2,000 ft. higher, on the north side of the stream. The Central vein was the first tin vein worked in this region. It was discovered in 1900 by José Bueno, a gold miner of the Araca district, from whom it was acquired by Harrison and Boettiger. The operation of the blacklist during the war caused a reorganization as a Chilean company under the name Empresa de Estaño de Araca. Nevertheless, the mine was kept on the blacklist, and its production consequently was considerably hampered. Whereas the pre-war production had reached 150 tons of barilla[1] monthly, in 1919 the mine was producing at the rate of only 100 tons. Nearly one-half of the production comes from the operations of contractors, who concentrate with the crude native quimbaletes (crude ore mills) maritatas, or hand jigs, and buddles.

The country rock in the immediate vicinity of the veins is a thick series of Lower Devonian shales, in which a few sandstone and quartzite beds are interstratified. The veins are not far distant, however, from the granite constituting the summit of the range. The shales are cut by a network of veins, the principal ones being the Central and the Pireo. Southeast of the Pireo are several veins on which little work has been done, and between the Pireo and Central are other subordinate veins. A number of veins northwest of the Central have been more productive, notably the Esperanza and Jinebra.

The Pireo and Central veins have been followed several hundred meters along the strike. The maximum width of stopeable ore has been 50 ft.; and it generally is more than 3 ft. For the most part the vein walls are not well defined, though in some places the mineraliza-



SKETCH MAP OF CARACOLES AND VICINITY

tion is confined between definite fracture planes. Much of the ore resembles slate at first glance, but it has a higher lustre and a cassiterite brown color. The typical ore is consequently extremely fine-grained and compact. Nevertheless, there are druses with excellent cassiterite crystals, some an inch or more in diameter. In fact, these veins are noted above all other Bolivian localities

[1] A 60 per cent tin concentrate.

for the occurrence of crystallized cassiterite. Intersections of the principal veins and secondary veins are generally the loci of large and rich oreshoots. The mode of occurrence of the cassiterite is, therefore, as wide bands or streaks of "guia," that is, high-grade ore, as minute veinlets penetrating the shale, and as a replacement of the shale. Associated with the cassiterite are quartz, the hydroxides of iron, and country rock. No tourmaline was seen, but this mineral is said to be encountered occasionally in small quantity.

The San José mill is connected with the mine by aërial tram. After crushing, the ore is ground with stamps and Krupp ball mills and concentrated on jigs, Humboldt and Ferrari tables and buddles to a final concentrate carrying 60 per cent tin. About one-half of the concentrate is recovered on the jigs and one-fourth each from the tables and buddles. The average tenor of the crude ore is about 4 per cent tin.

THE TARUJHUMAÑA MILL AT TANAPACA, A BOLIVIAN TIN MINE IN ITS INFANCY

THE CHOJÑACOTA TIN VEINS, THEIR EXPLOITATION AND GEOLOGY

The mine and mill of the Compañía General de Minas en Bolivia, a Bolivian company, are in the Chojñacota Cañon (Green Lake), a branch of the Yaco River, at the foot of an immense glacier which flows from Jachacunocollo Peak (The Great Snow Mountain). The elevation of the mill is 15,700 ft., and that of the mine 17,000 ft. Chojñacota lies about twenty miles south of Araca. The first veins to be worked here were on the ridge on the south side of the canyon, but they are now abandoned. The veins on the north side were discovered about six years ago. Four years ago a small mill was erected, and it is now being remodeled and considerably enlarged. In 1919 the daily production was increased to twenty-five tons of ore running 10 to 12 per cent tin, which yielded 2½ tons of concentrate with a tin content of 70 per cent. The company expects to increase the output to 150 tons of ore daily.

The veins are inclosed in a thick series of shales which vary in character from hard, thick-bedded shales like those at Araca to thin-bedded, fissile, black shales. Interstratified with the shales are sandstones and quartzites. Northeast of the veins the dip flattens as the crest of an anticline is approached. Fragments of the granitic rock that come down from the neighboring peaks of the main range consist of a uniformly medium-grained rock, unlike the coarse porphyrite rock seen at Araca.

Two principal veins are being worked, the Ferrecio and the San Luis. The two veins are separated by an E.-W. fault, and the San Luis lies on the north side of the fault. Adjoining the Ferrecio vein are five smaller veins, but most of the development work has been done on the San Luis vein, which averages 4 to 6 ft. wide. In general it is wider and richer in the soft fissile shales and narrower and poorer in the hard shales. It is not a fissure filling, but a zone of crushing in which the fractures have been filled with the ore minerals. The vein minerals are white quartz, which is commonly well crystallized; cassiterite, which is prone to occur in grains intercrystallized with the quartz; considerable black sphalerite, chalcopyrite, which is widespread but not abundant in amount; a little arsenopyrite and pyrite, and the hydroxides of iron. The fragments of shale are not usually mineralized as at Araca, so that the ore is distinctly brecciated in texture and much more coarsely crystallized. Younger than the previously mentioned minerals is siderite. It occurs chiefly in veinlets outside of the vein walls and as crystals superimposed on quartz within the vein.

The mine is connected with the mill by a 4,000-ft. aërial tram. The ore is crushed and then ground in Hardinge mills. The mill pulp is concentrated on jigs, tables, and buddles. Wilfley, Deister, and Ferrari tables are in use.

The Monte Blanco property was acquired by the

Empresa Minera Monte Blanco, a Chilean company, soon after the discovery of the veins, and a mill was erected fifteen years ago. The mill is situated in the next canyon south of the Chojñacota mine, known as Soracachi, at an elevation of 16,000 ft. It lies between two glacial lakes, Huallatani and Iscayuni. The upper lake, Huallatani, has a length of 1½ miles, a width of about 1,000 yards, and a fall of 450 feet, so that it is capable of supplying an enormous amount of power. The monthly production of the property is thirty tons of concentrate with a tin content of 66 per cent. The average grade of the ore treated is only a little over 2 per cent tin.

The country rock of the Monte Blanco veins is identical with that at Chojñacota. The veins are in a ridge on the south side of Lake Huallatani, which forms the divide between the Soracachi canyon and a canyon which flows on the eastern side of the Quimsa Cruz Range, that is, at the southern extremity of the high snowy ridge of that range. The mine workings are at elevations of 17,000 to 18,000 ft. The active workings are divided into three sections or mines, called respectively the Santa Fé, Serreno, and San Luis.

In the Santa Fé there are three principal veins, the average width of which is 1 ft., and which follow well-defined fracture planes cutting shales and quartzites alike, and are either simple fissure veins or lode fissures. There is much vein quartz and considerable tourmaline occurring in tufts of radiating crystals in the quartz and cassiterite. Some of the cassiterite is dark in color, but most of it is chocolate brown to lighter. But little pyrite occurs in these veins.

Markedly different in character is the Serreno orebody, which has a maximum width of 130 ft., the ore occurring in a white quartzite, interbedded in hard shales. The orebody is a stockwork in the white quartzite and has a very irregular shape and transitional boundaries. Its long direction seems to be parallel to the strike of the strata. The quartzite has been shattered into a network of minute fractures which are filled with the ore minerals. Locally, the fractures are parallel and give rise to an ore with sheeted structure. Where such fractures are minute and closely spaced, the ore has a banded appearance. Some of the fractures are filled with cassiterite, others with tourmaline, and in many the two minerals are mixed. Tourmaline also occurs in small bunches with cassiterite disseminated through them. Recently, a similar orebody, called the Donoso, has been discovered northeast of the Serreno.

Connection between the mine and mill is by a 2,000-yd. tramway along the ridge and an aërial tram between the mill and the terminus of the tramway. Shorter aërial trams bring the ore down from the mines to the tramway. The ore is ground in Huntington and Chilean mills, and concentrated on jigs, Butchart, Overstrom, and Deister tables, and buddles. The mill tailings carry 0.8 per cent tin, and are reworked in a small separate mill and finally discharged into Lake Iscayuni with a tin content of 0.5 per cent.

The Caracoles Veins Occur in Granite

The Empresa Minera Caracoles embraced a large group of claims at the head of one of the branches of the Choquetanga valley, directly across the range and a little to the north of Chojñacota. The property was being developed by Bricker and Guzman until purchased by the Guggenheim Brothers about eleven months ago. The country rock of the vicinity is a medium-grained biotite granite which also carries a little pyrrhotite. The granite is characterized by a well-developed system of parallel joint planes or sheeting. In places the fractures are only a few inches apart, and rarely is the interval more than a foot or two.

The tin veins cut the main system of fractures at a very acute angle and are numerous. They are usually grouped in systems and are not as a rule the filling of a single isolated fissure. These veins and the Pacuni veins are distinct from the rest of the veins in the Quimsa Cruz Range, in that they occur in the granite instead of in the sedimentaries. The characteristics of the fissures in the sedimentaries are lack of persistence and a tendency to split up, due to the variation in the physical character of the beds of the sedimentary series. The greater homogeneity and brittleness of the granite are believed to be factors favoring more persistent and well-defined fracturing. The veins of this part of the range are, consequently, regarded as more promising than those of the rest of the range. Another feature of many of the veins is that they show up far better underground than is indicated by their outcrops.

The principal veins, or vein systems, are the Huanchaca, the Pepita, the Antofagasta, the Llamero, the Carmen Rosa, and the San Enrique. A little work has

ENTRANCE TO THE ANGOSTURA, A GORGE OF LA PAZ RIVER, WHERE IT SAWS ITS WAY THROUGH THE MAIN RANGE OF THE ANDES BETWEEN THE CHOQUETANGA PEAKS AND ILLIMANI

also been done on the Bricker vein. The Antofagasta vein is connected by an aërial tram with the Elena mill, and the San Enrique, Carmen Rosa, and Llamero veins are connected with the Caracoles mill. The two mills are in the valley about a mile apart. The Elena mill has been dismantled by the new owners. The Caracoles mill is equipped with crusher, two Hardinge mills, three tables, and buddles. The production of the two mills in 1919 was thirty to forty tons of tin concentrates monthly. The Carasoles mill is at an elevation of nearly 16,000 ft., and the mine workings are still higher. The relative positions of the mills and mines are shown on the sketch on page 987. A new mill to serve the entire property is to be erected at a lower elevation in the Choquetanga valley.

The San Enrique vein is being developed by an adit. Several branch veins leave the main vein, the width of which varies from 1½ to 6½ ft. Tourmaline with a little quartz and arsenopyrite are the principal gangue minerals. Hand-sorted ore is said to contain 10 per cent tin. The vein walls are decomposed granite, which is usually tough and gouge-like, but still preserves the granitic texture.

THE MONTE BLANCO MILL. A MODERN TIN MILL AT AN ALTITUDE OF NEARLY 16,000 FT. LOWER DEVONIAN SHALES CONSTITUTE THE COUNTRY ROCK

The Carmen Rosa vein is being developed by two adits. Its width is quite irregular and reaches a maximum of over 6 ft. in one shoot. The filling is essentially tourmaline, in which are veinlets of quartz with much sphalerite and some pyrite. The tin content of the ore is said to average 8 per cent.

The Llamero vein has been but little developed and is frozen to the granite walls. At the entrance to the adit the vein is about 6 ft. wide, but it includes some granite horses. The filling is chiefly tourmaline, though there is also drusy quartz and some sphalerite. The ore is said to average 8 per cent tin.

The three veins just described were being actively exploited in 1919. The new owners regard them with less favor, however, and are concentrating their attention to the vicinity of the Antofagasta and Pepita veins, where a deep crosscut tunnel is to be driven from the bottom of the valley a short distance above the old Elena mill.

THE PACUNI VEINS CONTAIN TUNGSTEN AND TIN

The property of the Empresa Minera Pacuni Blanca N. Dillon is located on the southern slope of the Serrania de Pacuni and has also been purchased by the Guggenheim Brothers. The mill is at an elevation of about 15,000 ft. The mine is still higher and the vertical interval between the lowest and highest workings is about 1,500 ft. The veins are tungsten veins, and at the height of the tungsten boom the mine produced thirty-five to forty tons of 70 per cent tungsten oxide concentrates monthly. The concentrates contain about 2 per cent tin. The mill has been completely dismantled since the acquisition of the property by the Guggenheims, and the ore will be treated at the new mill to be erected in the Choquetanga valley.

The principal veins are the Blanca and the Inca. They are cut at right angles by a tin vein, the Veta Grande, which is now also being developed. The tungsten veins are nearly parallel to the main system of sheeting in the granite. The Blanca vein averages 2 to 2½ ft. in width. The filling is chiefly coarsely crystallized quartz and wolframite, with a little tourmaline and pyrite. The Inca vein lies east of the Blanca. Its width ranges between 10 in. and 1½ ft. Its filling is like that of the Blanca in some places, but in others it is softer and iron-stained, and even consists of "llampu," or soft oxidized ore. The average grade of the Pacuni ore is given at 12 per cent tungsten oxide.

The Potash Industry of India

Potash production in India, according to *Commerce Reports*, is a fairly old-established industry, and in the last ten years the annual production has varied between 15,000 and 25,000 tons. This yield might be increased by the adoption of improved plant and the concentration of the salt manufacture, as well as by the recovery of potash from the mother liquors and from the blast-furnace gases.

So far no good quality of phosphate of lime has been found in India suitable for the production of superphosphates, most of the phosphate having been found in the form of nodules containing a high percentage of carbonate. These, consequently, are unsuitable for the usual sulphuric-acid treatment.

The deposits of mixed phosphates of lime and aluminum found in parts of Bengal are also not suited for the acid treatment. There are, however, particularly rich and suitable deposits along the Red Sea, which could be shipped to the west coast ports, and these would supply all, or at any rate a large part, of the demand, provided suitable plant were obtainable and ample supplies of sulphuric acid were forthcoming.

Smelter Laboratory of the United Verde Extension

Most of the Disagreeable Features of Older Construction Eliminated—Large Windows and Glass Partitions Assure Ample Light—Filtrate Launders and Stands for Dispensing Burettes Convenient Accessories

BY H. O. HAMMOND
Chief Chemist, United Verde Extension Mining Co., Clemenceau, Ariz.

Written for *Engineering and Mining Journal*

ONE of the newer smelter laboratories in the West is that at the United Verde Extension Mining Co. smelter, situated in the Verde Valley, approximately seven miles from Jerome, Ariz. Operations here were begun in July, 1918. The smelting equipment includes one blast furnace and two pulverized-coal reverberatories, with a three-stand converter installation. There are also six roasting furnaces.

The laboratory is one of a group of brick buildings at the entrance to the plant, comprising, in addition, a general office, change house, and time office. It has a single story, with basement and flat roof. The inside dimensions of the building are 44 x 70 ft. Much time was given to the design of the interior, particularly to the arrangement of rooms and placing of apparatus, so that maximum convenience and accessibility would be assured for the routine laboratory operations. All the rooms have ample windows, and to a large extent the partitions between them are glass paneled. The walls and ceilings are of plaster, tinted in buff and light blue-gray, with the exception of the main chemical laboratory and fire assay room, which are ceiled with wood. The woodwork was given three coats of Toch Bros. laboratory enamel, ivory tint. This gives a very pleasing effect, does not discolor, and can be kept immaculate. The floors are of pine, stained. The fire, assay and furnace rooms have concrete floors.

Hot and cold water is available at each sink, and the distilled water used for analysis is heated by electric immersion coils in five-gallon nickel-plated urns with block tin lining.

The outstanding features of the laboratory include down-draft hoods, solid concrete balance tables, waste-liquor launders under filtering stands, large revolving stands for dispensing burettes, a special room for use as a research or experimental laboratory, unusually large storage rooms in the basement for various supplies, and a lunch and locker room for the chemists.

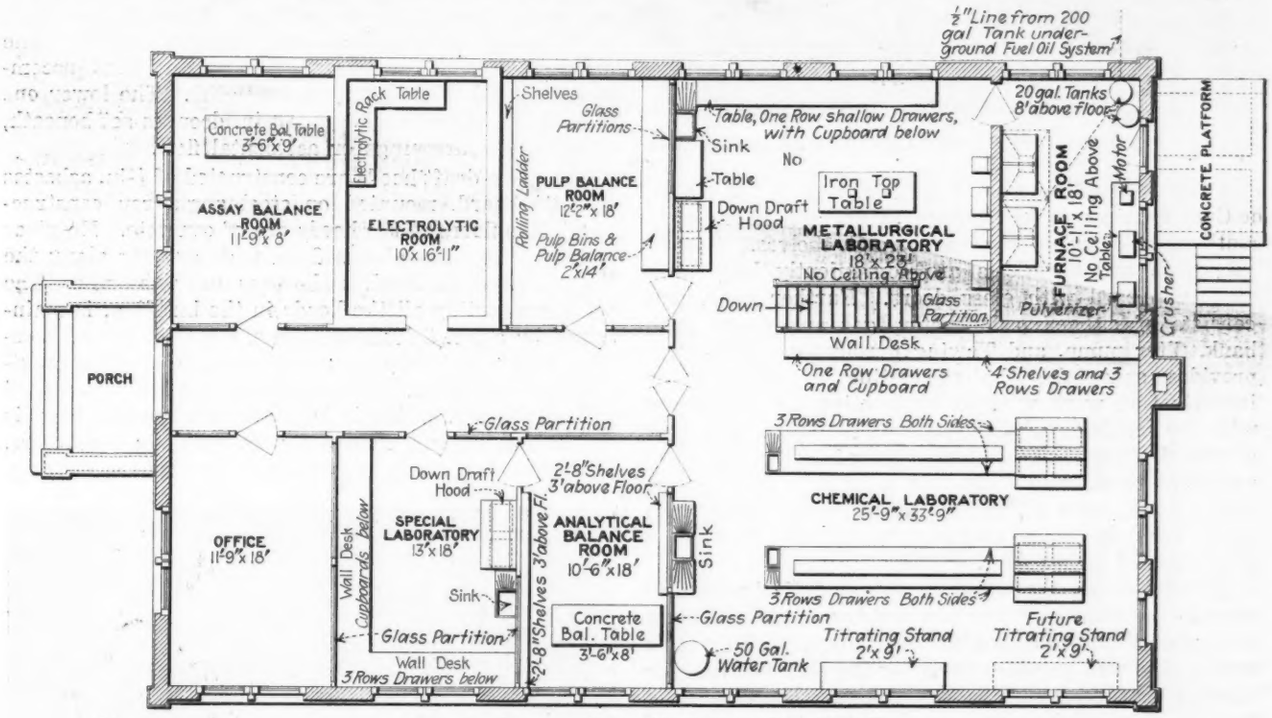


FIG. 1. FLOOR PLAN OF THE LABORATORY

Fig. 1, a floor plan of the laboratory, shows the general layout of the rooms. Upon entering the building, at the right of the hall is the office. Across the hall, to the left, is the fine-balance room. The equipment here consists of Heusser, Keller and Becker balances, placed on an all-concrete balance table, surfaced with neat cement, with foundation pier in the basement. In addition, this room contains the recording apparatus for the meteorological station instruments, which are mounted out of doors. These instruments give a continuous record of wind direction and velocity, sunshine, rainfall and barometric pressure. The outdoor station includes a hygro-thermograph, maximum and minimum thermometers, stationary and sling psychrometers, and a rain gage.

Adjoining the balance room is the electrolytic room,

with tables and rack for copper electrolysis. Stationary electrodes only are used. A motor-generator set, switchboard, and meter panel complete this room. The plant circuit is alternating current, and the motor generator charges direct current to a group of twenty-two storage battery cells (placed in the basement), which supply the current for electrolysis. This room is a vault, with solid concrete walls, roof, and floor. Bars are placed at the windows, and the door is of plate steel with Yale deadlock. These precautions were taken as a means of protection for the laboratory supply of platinum.

The special laboratory is completely fitted with a

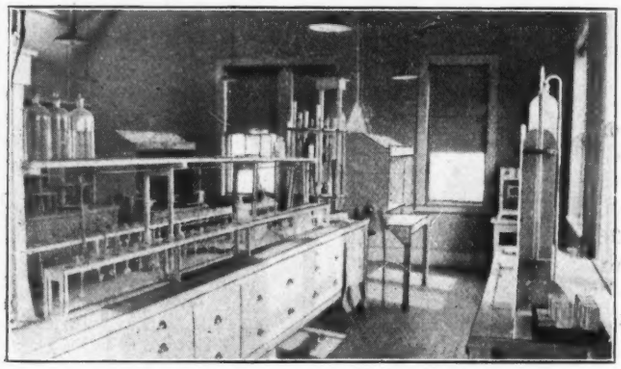


FIG. 2. A VIEW IN THE MAIN CHEMICAL LABORATORY

down-draft hood for two 18 x 24-in. electric hot plates, tables, filtering racks, burette stand, stoneware sink, and ample drawers, cupboards, and shelves. Special glassware and chemicals are conveniently kept in a small cupboard with glass doors. Further equipment consists of a bomb calorimeter, gas apparatus, lamp bank, filter pump, and Thwing pyrometer. This room provides space for the conducting of research or investigation work without obstructing or interfering with the regular analytical work of the office. A swing door leads from the special laboratory into the analytical weighing room, which also has a large, solid concrete center table, upon which are the balances. This room leads into the main chemical laboratory through a glass-paneled swing door.

Directly across the hall from the analytical weighing room is the assay pulp room, where the crucible charges are weighed and prepared for fire fusion. A long table against the wall provides room for the pulp balance, for mixing charges, and like operations. Underneath a portion of this table are large bins for the storage of crucibles, and above is the flux box, divided into compartments and fitted with hinged lids. Along the entire wall, adjacent to the vault, are shelves, subdivided into compartments, for storage of sample pulps. A traveling ladder makes them accessible. This room opens into the metallurgical laboratory and furnace room, which is separated from the main chemical laboratory by a glass partition with a double, open doorway between.

The main chemical laboratory is a room 35 x 26 ft. The two work tables are set lengthwise with the room, with a double down-draft hood at the end of each table, containing two 18 x 24-in. electric hot plates for each side of each table. These tables (see Fig. 2) are fitted with drawers and cupboards, and have small stoneware sinks (12 x 18 in.) at the ends opposite from the hoods. These sinks catch the flow from the waste-liquor launder, which is of ¼-in. lead, painted with asphaltum, and which passes directly under the stationary filter rack. The waste liquor passes out through a lead pipe ¼ in. thick into a tile sewer main. Light wooden strips fit over the launder, flush with the table top. These strips can be inserted when the filtrate is to be saved or removed when the filtrate is not desired. Provision is made for flushing these launders, which have a slight gradient, with tap water. A light shelf is mounted along the center of the table, two feet above the table top, for keeping at hand solution and reagent bottles. Above the shelf is placed a hot-water urn for distilled water, which is conducted along the table through a ⅜-in. block tin pipe.

At the table end adjacent to the hood is set the revolving stand for dispensing burettes (see Fig. 3), and it has proved a most useful adjunct. There is only one stand to each table, as it is equally accessible from either side. The stands are of wood, 24 in. in diameter, and hold twelve 250 or 500 c.c. dispensing burettes. The use of the dispensing burette has proved to be far superior to the system using reagent bottles and graduates. It is quicker, easier, and less wasteful. The burettes rest in slots, cut into the edge of an upper and lower circular wooden section. A small fiber catch on the upper section holds each burette in place. The upper section is adjustable for height, thus accommodating burettes of different lengths. The lower one is fixed. A circular lead pan, 3 in. deep, is set beneath, to catch any drippings or accidental flow.

The down-draft hoods are constructed of ½-in. asbestos transite board, mounted on steel angle-iron construction. The floors of the hoods are of concrete. No glass is used. An exhaust flue 3 in. wide extends along the back, inside the hood, and opens near the top. The draft, connecting all the hoods in the building, is maintained by a No. 5 Buffalo blower, mounted in the basement and operated by electric motor at a speed approximating 1,400 r.p.m. Each hood exhaust flue is provided with a damper, which is kept closed when the hood is not in use, thereby increasing the draft in the others. The connecting flues, which are run under the flooring,

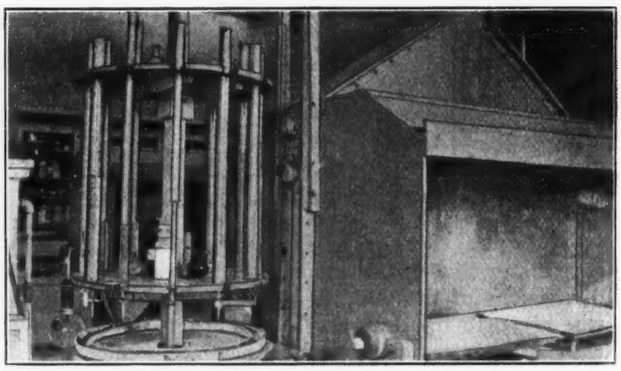


FIG. 3. REVOLVING STAND FOR DISPENSING BURETTES AND DOWN-DRAFT HOOD

are of transite construction, coated on the interior with paraffin paint, to prevent corrosion. The joints of the flues were sealed with an asbestos fiber cement. A brick stack at the rear of the building serves to lead off the fumes of the exhaust from the blower.

Along one wall is a wall desk with drawers and cupboards, surmounted at one end by a large cabinet with glass doors, which is kept stocked with all chemicals and smaller supplies in current use. Acids are

dispensed from the regulation three-quart bottles furnished by the manufacturer. These are fitted with glass delivery tubes and aspirator bulbs. These bottles are kept on a small table with a lead top.

Further equipment in this room consists of a titrating burette stand of seven burettes. The standard solutions in use on this stand are kept in cupboards beneath and away from the light, being forced into the burettes by bulb pressure. There is a 30-gal. copper water tank, tin lined, for distilled water, and a large main sink of stoneware with drain boards at each end. Samples are dried in a Freas automatic electric drying oven.

The fire assay laboratory (see Fig. 4) has four Case muffle oil-burning furnaces. These are set up in the rear of an 8-in. brick wall, thereby reducing the heat radiation. The muffle apertures, only, appear in this room. An iron table, with shelf below, serves the assay operations. At one side of the room is a down-draft hood, with electric hot plate for the parting operation. Adjoining is a wall table with filter stand and a stoneware sink; also a small wall desk with drawers and cupboards. The hood has also mounted in it, and separated by a partition from the hot plate, a Hoskins electric muffle furnace, F. D. No. 204. The heating of this furnace is varied and controlled by a wall rheostat.

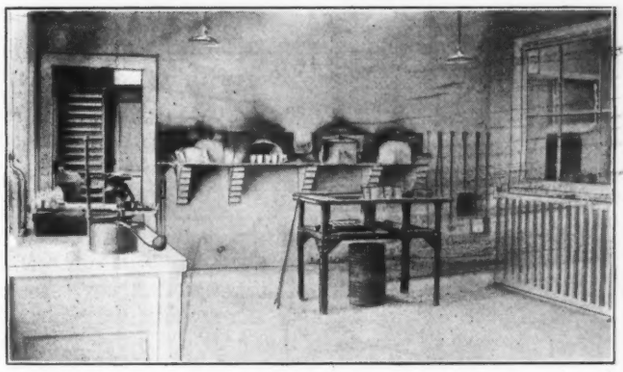


FIG. 4. THE FURNACE ROOM

The draft can be regulated by a damper set in the hood flue.

A swing door leads into the furnace room proper, where are the Case furnaces, burners, low-pressure blowers, motors and oil tanks, and pipe connections. A 26-deg. Bé oil is used and has proved satisfactory with no pre-heating. A 200-gal. steel tank is buried in the ground outside the rear of the building at a shallow depth and is connected with a filter pipe from the surface. The fuel oil is pumped from this tank by a small rotary hand pump, situated in the basement, to two 20-gal. service tanks in the furnace room, which are placed slightly higher than the top of the furnaces. A 60-in. stack takes the waste gases from the furnace hoods. An increased draft was obtained here by placing swing aprons of sheet iron from the sides of the hoods and fitted close down about the top of the furnace body. This room also contains an Iler cupel-making machine and shelf cabinet for cupel storage. The room has a concrete floor and ceiling and is well ventilated.

The basement contains a lavatory and shower-bath room; also a locker and lunch room, roomy and well lighted. A small room is used for the storage battery mounted under a hood connecting with the down-draft system. One large room the total width of the building serves as a general storeroom for all supplies and heavy bulk stock not in current use. The samples and chemicals are kept in a separate dark vault. Additional space is devoted to a small crusher and pulverizer, power driven, a hand grinding mill for fluxes, a large revolving mixer, a bucking board, and long workbench.

The building is heated throughout with steam, supplied from the power plant to radiators in each room on the main floor. The basement is heated sufficiently from the exposed steam mains.

After two years' use, this laboratory has proved in every way to be entirely satisfactory for the purposes for which it was designed.

Fluorspar in 1919

PRODUCTION

Reports received from most of the principal producers of fluorspar, according to Hubert W. Davis, of the U. S. Geological Survey, indicate that the total shipments from domestic mines in 1919 amounted to about 122,000 short tons, valued at $3,102,000, as compared with 263,817 tons, valued at $5,465,481, in 1918. These figures show a decrease in quantity of 54 per cent and a decrease in value of 43 per cent. The general average price per ton f.o.b. at mines or shipping points for all grades of fluorspar in 1919 was $25.43, which is $4.71 per ton more than the average price received in 1918. The average price received in 1919 was higher than the average quoted price during the year, because a considerable quantity of gravel spar was so'd in 1918 for delivery in 1919 at prices between $30 and $35 a ton. On the other hand, the average price reported in 1918 was lower than the average price quoted during that year, because a considerable quantity of gravel spar was being delivered on old contracts at prices between $5 and $10 a ton. Kentucky and Illinois fluorspar was quoted during practically the whole of 1919 at $25 a ton f.o.b. at mines for 85 per cent washed gravel spar, and at $22.50 a ton for 80 per cent similar material, but according to reports these prices were often shaded.

IMPORTS

The imports of fluorspar into the United States in 1919 were 6,943 short tons, valued at $107,631, as compared with 12,572 tons, valued at $169,364, in 1918, a decrease in quantity of 45 per cent and in value of 36 per cent. The value at the foreign ports of shipment assigned to the imports in 1919 averaged $15.50 a ton, as compared with $13.47 in 1918, an increase of $2.03 a ton. Of the imports in 1919, England furnished 6,041 tons, valued at $94,099. or $15.58 a ton at the British port of shipment, and Canada furnished 902 tons, valued at $13,532, or $15 a ton.

The imports of fluorspar into the United States during the first three months of 1920 amounted to 3,820 short tons, valued at $37,233, or $9.75 a ton at the ports of shipment. During this period a small quantity of fluorspar was received from Germany.

Reported Diamond Deposits in British East Africa

A recent report from Nairobi, British East Africa, says that within thirty miles of the consulate what three experts pronounce as diamonds have been found. All the claims of the negotiators have been pegged out.

Transportation in Sze-Chuan, China

Development of Possible Industries Retarded by Adverse Conditions—Railroads Lacking—All Machinery and Supplies Carried by River, Coolie or on Pack Animals—Labor Scarce in Some Districts in Consequence

BY J. A. T. ROBERTSON
Written for *Engineering and Mining Journal*

ANY expansion in China's mining industry must come largely from further development of known deposits. This will require a change in economic conditions. I confess that I went to China with the impression that the introduction of Western machinery and methods would decrease costs sufficiently to permit the opening of deposits that cannot be worked under present conditions; but I soon found that many deposits are being successfully worked on a small scale that are obviously too small to justify capital expenditure for a modern plant. Also, in a great many operations the methods employed are far more economical than would appear to the casual observer. For example, after seeing the Chinese recover silver by direct cupellation from lead bullion containing only about 15 ounces per ton, and washing gold from gravel that an American miner could hardly dredge, it did not take long to force the realization that the wholesale application of foreign machinery is not what is needed.

The Chinese have never been able to contend with any volume of water below the natural drainage levels; therefore very little is known of the possible extension of ore with depth. In my opinion this offers one of the greatest possibilities of expansion. But although the Chinese have never developed a suitable pump they have been familiar with foreign pumping machinery for a long time, and that they have not used it more extensively is solely because of present economic conditions. It appears to me that improvement in transportation will be one of the biggest factors in changing economic conditions in China.

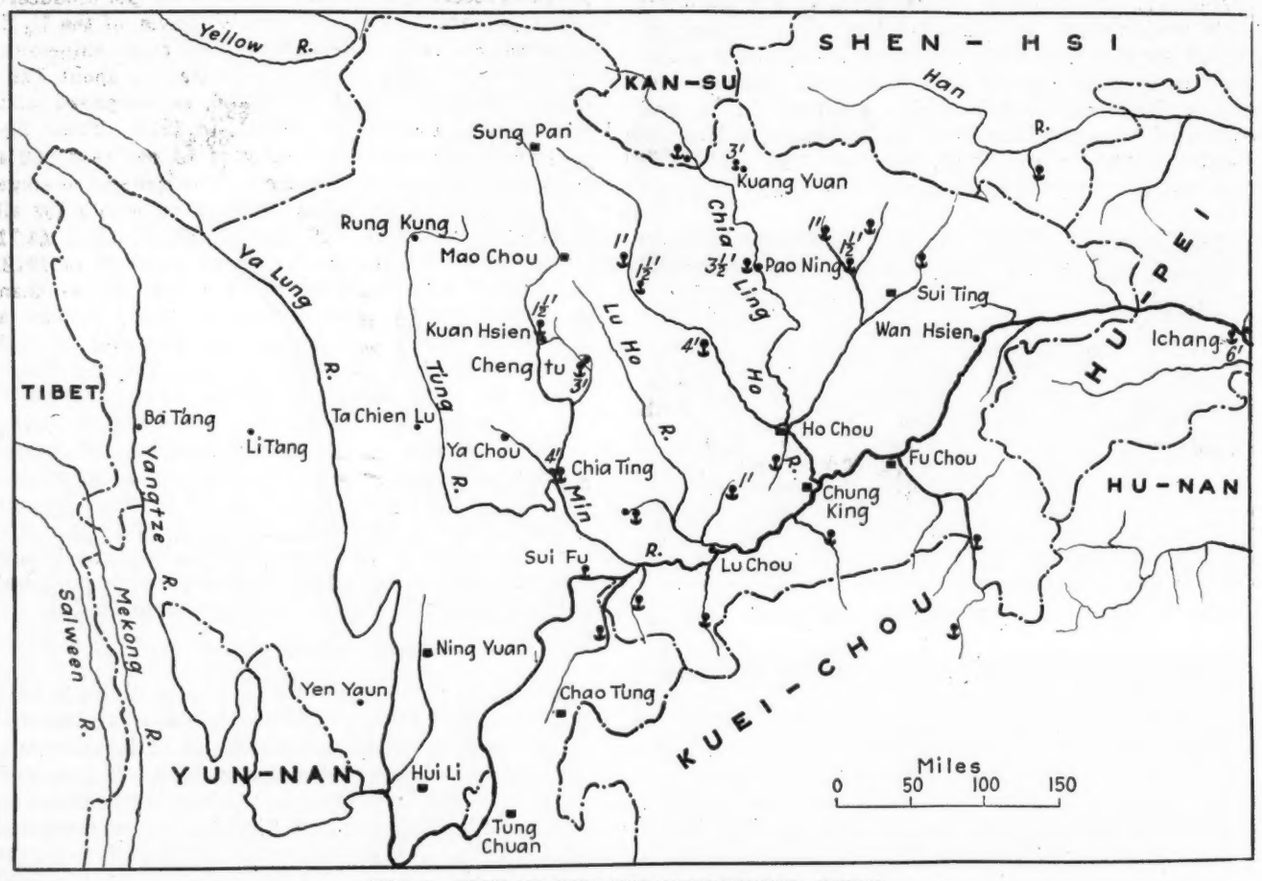


FIG. 1. MAP OF SZE-CHUAN PROVINCE, CHINA

North of Chung King there are some very promising iron deposits that have been worked over a large area. The ore is smelted in charcoal furnaces near by. When the wood has been used up in an area within which the charcoal can be profitably transported to the smelter the workings are abandoned and a new mine is developed and furnaces are built at some other place on the range where wood is available for charcoal burning. This is only one of numerous instances that could be cited in which present transportation costs prevent the development of possible mining industries.

The copper smelter at Peh-Hsui-Ho operated only about half time because of lack of ore. The smelter was built as near to the mines as possible, but it was found impossible to get enough carriers to bring down more

than half the tonnage of ore that the smelter could treat. It sounds funny to talk of labor shortage in China, but I have known it to be quite acute in numerous mining districts of the Province of Sze-Chuan, which has a population of from sixty to seventy millions. Bishop James W. Bashford, who was an authority on things Chinese, estimated that 15 to 20 per cent of male Chinese are engaged in transportation. When this is compared with conditions in Great Britain, which is somewhat of a common carrier, where 6 to 8 per cent of adult labor is engaged in transportation, and with countries such as Austria, that transport only their

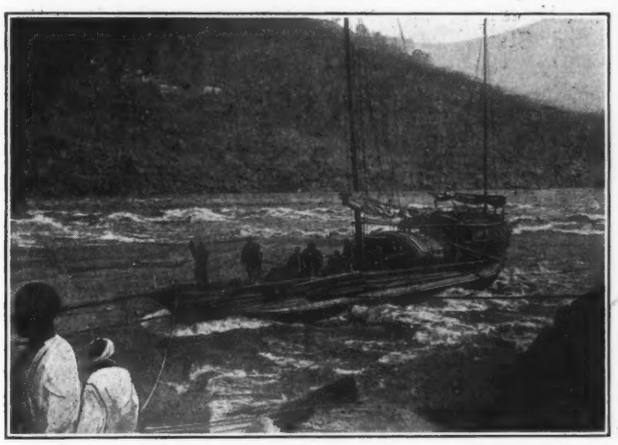


FIG. 2. A JUNK BEING TOWED UP-STREAM

own goods, where 2 or 3 per cent of the adult labor is thus engaged, it is not hard to understand the high cost of transportation or the shortage of labor in other industries.

Because transportation costs are such a vital factor in mining I am presenting these notes for the benefit of those interested in mining development in China. Although they refer specifically to Sze-Chuan, they represent conditions in a large part of the interior. The costs given are those obtaining in the summer of 1916, the last year I was in China, and are in United States currency figured on a value of 50c. for the Chinese silver dollar, which was the rate of exchange at the time. Since then the Chinese silver dollar has appreciated greatly in value, actually exceeding the United States dollar for a while in 1919; and even conservative China has not escaped the general increase in cost of everything during the last four years. Therefore present costs would be much higher than the figures given.

No Railroads in Sze-Chuan—River Transport Instead

Sze-Chuan, the largest of the eighteen provinces of China, is practically cut off from the rest of the country by mountain ranges. There is not a mile of railroad in the province, nor even anywhere near its borders. The only connection with the outside world is by way of that great highway of Central China, the Yang-tze River. Fortunately, the province, whose name means Four Rivers, has been well provided with waterways navigable for native craft. The accompanying sketch map shows some of the principal streams and head of navigation for boats of various draft. It will be noticed that this does not apply to the western part of the province, which is very rugged and whose streams flow so swiftly that it is often difficult to even ferry across them in their quieter stretches. However, in some cases, such as from Chia Ting to Ya Chow, bamboo rafts are used to extend navigation beyond the limits of any kind of boat.

Most freight is transferred to river steamers at Shanghai, although ocean freighters do ascend the river to Hankow, 600 miles from the sea. Here all freight is again transferred to smaller river craft, whose destination is Ichang, about 1,100 miles from Shanghai. Freight on crated machinery, sent from New York to Ichang, was $22 per ship's ton. From Ichang to Chung King, a distance of about 500 miles, there are a number of shallow-draft steamers plying about eight months of the year. Most heavy freight goes up from Ichang by native junk, requiring one month or more, depending on the height of the water and the prevailing winds, as against from four to six days by steamer. At Chung King it must again be transferred to smaller native boats and may be transferred once or twice again before it reaches its destination. This is exceedingly slow, and the risk of loss on the river is great.

Anything that will be damaged by water should be packed in tin-lined cases or cans and hermetically sealed, for not many wrecks in the smaller streams are total losses. I remember one instance when a boat which happened to have my year's supply of sugar and white flour was wrecked just below Chia Ting. It had fallen behind the other boats, and our representative was not there; so the captain walked up to Chengtu, four days' journey, to ask if we wanted him to fish the cargo out of the river and transfer to another boat. Although the cargo was under water about ten days, I lost only one 10-lb. tin of sugar, and it had had a nail driven into it in boxing. But one is exceedingly fortunate if his freight can be delivered by river, for then weight of the individual piece is not so important. If the destination is any distance from a navigable stream the

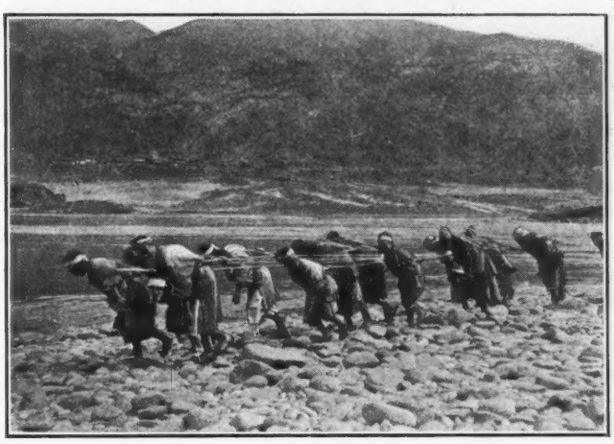


FIG. 3. A TOWING PARTY OF COOLIES

weight and size of the largest piece is of the utmost importance, a fact that is demonstrated by numerous heavy pieces of machinery I have seen rusting by the roadside where they were abandoned. The following costs per ton mile represent conditions:

TRANSPORTATION COSTS PER TON MILE IN SZE CHUAN IN 1916

Trip	Cost Per Ton Mile
Ichang to Chung King, by steamer	$0.0428–$0.0635
Ichang to Chung King, by native junk	0.0275
Chung King to Chia Ting, by native junk	0.011
Chung King to Chengtu, by native junk	0.012
Chung King to Tzu Liu Ching, by native junk	0.012
Chia Ting to Ya Chow, by bamboo raft	0.065
Down river freight	0.007– 0.01

The province where not actually mountainous is so hilly that in four years' travel I never saw a wagon road where an ox cart could be used, and even the wheelbarrow is limited to local use in a few of the valleys and basins. After leaving the waterways one has the choice of transport by coolie or pack animal, although in many districts the "Union of Carrying Coolies" will not allow the pack animals to come down out of the more mountainous sections, so one must choose coolies. For pack animals the limit for a single piece is 250 lb., but the usual loads vary from 160 to 220 lb., which the natives prefer to have divided in two equal parts.

With coolies probably the cheapest method is the back load or "beh." I have seen one man carrying well over 300 pounds in this way over rough mountain trails, but it is very slow. The quickest method of transport by coolie is the carrying pole, by means of which a man will carry 100 lb., 50 lb. on each end of the pole, from twenty-five to thirty miles a day. Where the roads are very hilly the load should be reduced to not over 40 lb. on each end. The maximum weight of a package to be carried by coolies is usually a question of cost. If one can afford to use enough men large

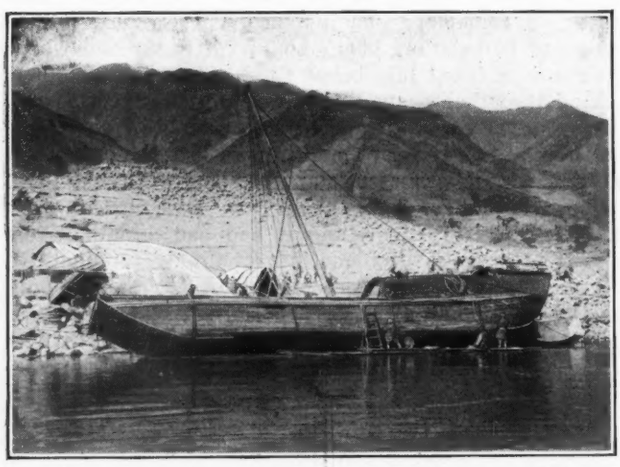


FIG. 4. REPAIRING A JUNK EN ROUTE. THE CARGO IS STOWED ON THE BANK UNDER THE SAIL

pieces can be carried. One man carries 100 lb.; two men, 160 lb.; three men 210 lb.; four men 260 lb.; and so on in about that proportion. But the greatest expense comes in the extra time needed by a large number of men. For example, from Ya Chow to Ning Yuan is considered a twelve-day trip, although it is usually made in ten days; but a load requiring ten or twelve men takes sixteen to twenty days.

Transportation by pack mule costs $0.088 to $0.15 per ton mile, depending on roads and load. Transportation by coolie, carrying on back, costs $0.10 per ton mile and up; by coolie, carrying a 100-lb. load on a pole, $0.125 to $0.20. Native express (coolie), the limit of weight being 90 lb., costs $0.129 per ton mile; heavier pieces are accepted at increasing rates, which soon double and treble.

Ontario's Siderite and Pig-Iron Production

Shipments of siderite ore from the Magpie mine by the Algoma Steel Corporation, and of briquettes produced from magnetitic ore by Moose Mountain, Ltd., Hutton Township, Ontario, totaled 13,962 short tons, valued at $74,073, from Jan. 1 to June 30, 1920, according to the Ontario Department of Mines. The first-mentioned used its entire output in the blast furnaces of the corporation at Sault Ste. Marie; the latter shipped its product to Quebec and the United States. The new Helen mine of the Algoma Steel Corporation has been diamond drilled, and it is estimated that over 100,000,000 tons of siderite are available for mining.

The pig-iron output by the Algoma Steel Corporation at Sault Ste. Marie, the Steel Co. of Canada at Hamilton, and the Canadian Furnace Co. at Port Colborne was 321,826 short tons, valued at $8,255,916. Only 58,387 tons, or 8.94 per cent of the total of 653,137 tons of ore charged to the seven furnaces in blast, was of domestic origin, the remainder being imported from the United States. Furnaces of the Midland Iron and Steel Co., the Parry Sound Iron Co., and the Standard Iron Co. were not operated during the period. The output of steel from pig iron was 337,048 tons, valued at $1,661,570. These figures do not include any secondary steel produced in the electric furnace from scrap iron and turnings.

Spain's Mineral Production

The output of the principal Spanish minerals during 1913, 1917, and 1918 was as follows, according to Consul General Carlton Bailey Hurst:

Minerals	1913 Metric Tons	1917 Metric Tons	1918 Metric Tons
Iron	9,861,668	5,551,071	4,692,651
Soft coal	3,782,214	5,042,213	6,134,986
Copper (a)	2,261,691	1,901,341	1,007,707
Iron pyrites	92[illegible],913	376,918	590,008
Common salt (b)	60,429	781,103	320,531
Lignite	276,791	637,841	726,348
Lead	279,078	240,368	216,133
Anthracite	232,517	324,756	377,216
Zinc	117,831	123,846	10[illegible],958
Sulphur	6[illegible],653	84,979	7[illegible],3[illegible]0
Quicksilver	1[illegible],960	18,[illegible]05	1[illegible],537
Manganese	21,594	57,[illegible]74	7[illegible],714
Silver-bearing lead	23,600	13,218	[illegible],505
Ocher	600	780	700
Silver	402	96	962

a Includes copper ore and ferrocupreous pyrites
b Includes rock salt and products of salt works.

Iron ore was mined in nineteen provinces of Spain during 1918, comprising a total of 430 productive concessions, 107 of which were located in Vizcaya. Great Britain was the chief purchaser of iron ore from Spain before the war, and, with Germany, The Netherlands, and France, took large shipments. However, owing to the blockade, this export was reduced, Great Britain remaining practically the only purchaser. The result is that, although less ore has been mined, large stocks have accumulated. The chaotic condition of European iron industries in 1919, and restriction placed on the export from Spain of unmanufactured iron and steel, have tended to reduce production in the local iron mines.

It is conservatively estimated that the output of copper pyrites in Spain represented about 60 per cent of the world's production in 1918, and the Spanish mines are now in a position to produce more than before the war. Domestic consumption, which decreased owing to the limited development of chemical industries, promises in the near future to be greater through the establishment of new chemical enterprises.

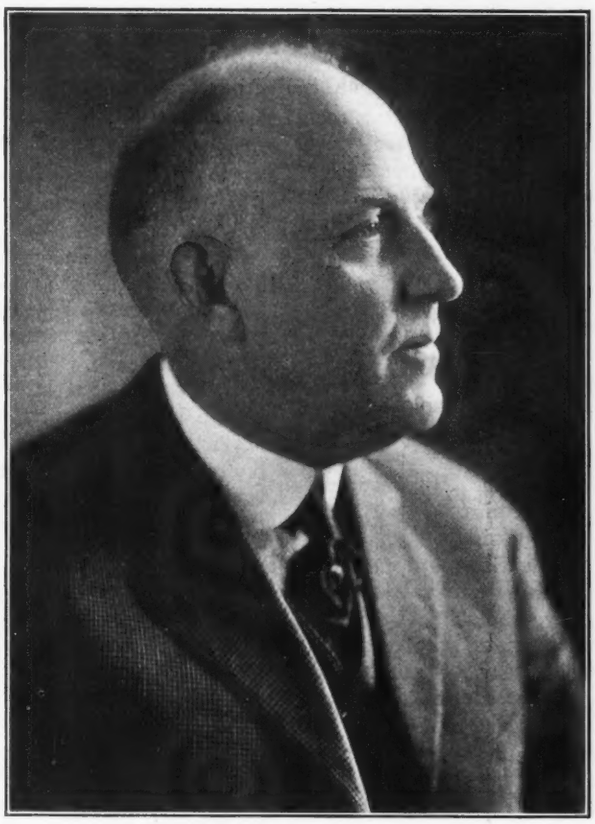
The lead crisis resulting from the war threatened to paralyze lead mining, and early in 1919 the government authorized a committee to fix selling prices each month. It also granted a loan of 6,000,000 pesetas to the federated lead miners to meet the deficit caused by selling at the fixed price below the cost of exploitation. The demand for the suppression of the tax of 3 per cent on sales of lead ore was not conceded, but the export tax on certain lead ores was abolished.

Metallurgists of Note

Dorsey A. Lyon

BY PAUL WOOTON

DORSEY A. LYON, supervisor of the experiment stations of the U. S. Bureau of Mines, is said to know more mining and metallurgical men than any other individual in the United States. Throughout his entire career his duties have required travel between mining centers. The cumulative results are that literally thousands of men engaged in the mining industry have a personal acquaintance with Mr. Lyon. Practically his entire life has been spent in the Far West. He was thirty years old when he made his first trip east of Chicago. Mr. Lyon was born in Bureau County, Ill., in 1871. His early years were spent in western Kansas, where his parents moved soon after he was born. In this frontier environment he was reared. He received his entire elementary education from his mother. Later the family moved to Texas and then to New Mexico. Young Lyon studied at Drury College, in Springfield, Mo., and later at Stanford University, from which he was graduated in 1898. During his senior year he was student-instructor in chemistry. Following his graduation Mr. Lyon accepted a position as instructor in the geology of mining at the University of Washington. Later, when the school of mines was started in connection with that institution, he was its first dean, being succeeded by Milnor Roberts, the present dean. Mr. Lyon then took post-graduate work at Harvard University, where he obtained his master's degree in metallurgy in 1902. Immediately thereafter he accepted employment with the U. S. Mining & Smelting Co. in Utah, which was building its plant at Midvale—then called Bingham Junction. At this plant his first practical experience was in what Mr. Lyon terms "muscular metallurgy." He assisted with the construction of the plant and later was placed in charge of the feed floor.



DORSEY A. LYON

To fill an urgent vacancy at the staff of Stanford University, Mr. Lyon was borrowed until an instructor could be found. His stay proved longer than he had intended, lasting from 1903 to 1908. During the summers of 1905 and 1906 he conducted large-scale experiments with the electric furnace in connection with the smelting of copper ores. Later he began work with the electric furnace in the treatment of iron ores. He was in charge of extensive work of this character from 1907 to 1911. In the latter year he went abroad to study the use being made of the electric furnace in Sweden. On his return he spent some time in the Harvard laboratory studying the possibilities of reducing iron ore by oil. It happened that Mr. Lyon was doing his electric furnace work at the same time that Dr. F. G. Cottrell was developing his electrical precipitator. Each was much interested in the work of the other and they frequently collaborated in efforts to work out certain of the problems which they were meeting. When the Bureau of Mines was established, Dr. Holmes had Mr. Lyon slated as the Bureau's metallurgist. It happened just at that time that Mr. Lyon was working under contract for an English company, but at the expiration of this contract in March, 1912, he accepted a detail from the Bureau on some metallurgical experiments, which he conducted at the Harvard laboratory. On July 1, 1913, he received a Presidential appointment as metallurgist in charge of the Bureau's electric-furnace work.

In 1914 the Bureau of Mines undertook its first co-operative work. An agreement for metallurgical research was made with the University of Utah. One of the conditions of the agreement was that the investigations be supervised by a metallurgist of the Bureau of Mines. This work, which paved the way for the extensive co-operative investigations being directed by the Bureau, occupied most of Mr. Lyon's attention until 1917, when he was made superintendent of the Seattle Experiment Station. Later he became supervisor of the experiment stations, the position which he still retains.

Mr. Lyon, besides being a co-author of several bulletins of the Bureau of Mines dealing with the use of the electric furnace in metallurgical work, has written from time to time for various technical publications. He is a member of the A. I. M. E., the Mining and Metallurgical Society of America, the British Iron and Steel Institute, the Cosmos Club, and other societies.

By The Way

Confusing

"If the casual reader ran across the words 'lepidolite' and 'amblygonite' in a theological paper, he might mistake them for the names of tribes of the Philistines," says a Little Rock paper; "if he found them in a paper on fossils he might suppose they meant some kinds of armored reptiles that ranged the swamps of the Cretaceous period. A companion word, 'spodumene,' though it ends with 'mene,' would mean nothing to him." To these names of lithium minerals may be added "natalite," which is something new and not a mineral. It is a liquid manufactured in Natal from refuse of sugar-cane mills and is used extensively as a motor fuel in South Africa to meet the shortage of gasoline there. Natalite has possibilities, to judge from its description. There is no reason why it could not be manufactured in the sugar-cane fields of Louisiana.

A Gas Explosion

Something new in the manner of shuffling off this mortal coil was mentioned in the columns of the *Rocky Mountain News* recently. A peculiar explanation is given of the death at Gunnison, Col., of a certain George W. Johnson, a former resident of Pueblo. "At the time of his death," says the *News* item, "Johnson was believed to have died from heart failure. Now physicians say he was killed by an explosion of gas in his throat. Johnson had gone to the Sawtooth mine, in which he was interested, to examine a new ore found there. Early in the morning two shots had been fired within the mine, workers planning to stay away for nine hours until the gas would clear. At 2:30 p.m. Johnson entered, and shortly after an explosion was heard. He staggered from the mine and died soon after. Gas is supposed to have remained in the man's throat and to have exploded as he came into the pure air." It is not seemly to make light of such an occurrence. But, if such a thing can be, it is somewhat surprising that many accidents of the same sort did not take place all over the country just before election.

The Simple Life

In the very early days of gold diggings, miners did not require much outfit or many tools; and, under the circumstances, locomotion was easy. A single suit of clothes, consisting of woolen shirt, thick pantaloons, heavy boots, and slouch hat, often served for a long time without changing. Add to this the leather belt, usually carrying a revolver and always a bowie or butcher knife, and the man was in full dress. If he traveled on foot, he carried a roll of blankets for his bed, a knapsack of provisions consisting generally of pork and beans, a little flour and salt, perhaps a little coffee or tea, a dish or two for cooking, a large iron or tin pan for washing gold, a shovel and sometimes a pick. If he traveled with a horse or mule, and particularly if he had an extra pack animal, his outfit was more extensive, embracing larger and more varied supplies of provisions, more cooking utensils, more clothing and bedding, and many other tools and implements. When several traveled together and had pack animals, they ordinarily carried a tent; but often they were satisfied with brush booths hastily thrown together, or slept in the open air around their campfire.

Gold

E. Gould Buffum is quoted in Hittel's "History of California" as giving the following animated description of working a crevice on Weber Creek in the early part of December, 1848: "I shall never forget the delight with which I first struck and worked out a crevice. It was the second day after our installation in our little log hut—the first having been employed in what is called 'prospecting' or searching for the most favorable place at which to commence operations. I had slung pick, shovel, and bar upon my shoulder and trudged merrily away to a ravine about a mile from our house. Pick, shovel, and bar did their duty, and I soon had a large rock in view. Getting down into the excavation I had made, and seating myself upon the rock, I commenced a careful search for a crevice, and at last found one extending longitudinally along the rock. It appeared to be filled with a hard, bluish clay and gravel, which I took out with my knife; and there at the bottom, strewn along the whole length of the rock, was bright, yellow gold, in little pieces about the size and shape of a grain of barley. Eureka! oh, how my heart beat! I sat still and looked at it some minutes before I touched it, greedily drinking in the pleasure of gazing upon gold that was in my very grasp and feeling a sort of independent bravado in allowing it to remain there. When my eyes were sufficiently feasted, I scooped it out with the point of my knife and an iron spoon and, placing it in my pan, ran home with it much delighted. I weighed it and found that my first day's labor in the mines had made me thirty-one dollars richer than I was in the morning."

What Is a Bureaucrat?

Anything that ends in *crat* is not a popular term to apply to one nowadays, whether it be bureaucrat, aristocrat, plutocrat—even, possibly since the election, Democrat. Still, when we read our Washington correspondent's write-up of Dorsey Lyon, the energetic superintendent of our mining experiment stations, we feel that he can hardly escape the first if not the last of these terms. When a man is born in Bureau County (Ill.), dined, possibly, off the bureau after parental correction (not being tall enough for the mantel piece), punched a burro in the Far West, burrowed into the electric furnace at Harvard, was borrowed from Harvard by Stanford, and finally joined the Bureau of Mines, which, from the custom of transmitting the directorship from father to son (spiritually speaking) has been compared with the pocket boroughs of England, can he hope to escape this classification?

Improving Arizona

Following the example set by James Douglas in bestowing the name of "Clemenceau" on his townsite camp in the Verde Valley of Arizona, John C. Greenway has named the New Cornelia swimming pool at Ajo "Dauville." The spelling of this new name will probably be Anglicized into "Doughville" in the course of time, and all will readily understand that it was given in honor of the doughboys whom Colonel Greenway led over the top.

CONSULTATION

Money in the United States

"Although I realize that the *Engineering and Mining Journal* is not a purely financial organ, I shall appreciate it if you would give me an idea of the stock of money in the United States at the present time, and how it compares with a similar period in 1919?"

The following table is taken from the circulation statement of the Treasury Department, and furnishes a comparison between present monetary conditions and those of a similar period last year:

	Nov. 1, 1920	Nov. 1, 1919
Gold Coin (including bullion in Treasury)	$2,739,043,566	$2,872,525,066
Gold Certificates	.....	.....
Standard Silver Dollars	269,857,494	308,145,759
Silver Certificates	.....	.....
Subsidiary Silver	264,697,830	245,127,765
United States Notes	346,681,016	346,681,016
Federal Reserve Notes (a)	3,663,517,685	2,958,700,375
Federal Reserve Bank Notes	238,601,900	267,986,800
National Bank Notes	732,549,629	722,394,325
Total	$8,254,949,120	$7,721,561,106

(a) Includes own Federal Reserve Notes held by Federal Reserve Banks.

Mining Bonds and Leases

"Will you be good enough to advise me concerning the method of operation of a 'bond and lease'? I very frequently see this term used in connection with mining properties, and I would appreciate knowing in full detail just what this means and how it is worked out practically."

The term "bond and lease" as applied to mining operations is a common expression covering a contract in the industry whereby the owner of a mining claim or claims contracts to sell his property at a stipulated price and to deliver a valid deed therefor at any time before the expiration of the lease.

The ordinary mining lease is merely a simple contract by which the mine owner grants to the lessee, with perhaps some restrictions, the exclusive right to do a certain piece of work, for which the lessor is to receive payment in the form of a proportion of the net returns. The distinction between a mining lease and an ordinary business lease is that the mine owner shares risk as well as profit. The "bond" element of a "bond and lease" is the supplementary provision by which the purchase of the property can be effected. A bond and lease usually gives the lessee ample time in which to determine the merits of a property, and in the event of disappointment in its character the contract may be terminated. From the owner's or lessee's standpoint a lease will help to develop the mine through someone else's efforts, whereas a bond and lease will insure a sale should the development prove satisfactory. Furthermore, profits or royalties to the owner are net.

The question of royalties is usually decided upon a sliding-scale basis; that is, varying with the gross value of the ore produced and sold, and is computed on the net smelter returns after the necessary haulage, freight, and treatment charges are deducted. Thus, in the Leadville district, Colorado, ore running under $10 per ton may be subject to a royalty of 10 per cent; ore running from $10 to $15 per ton, 15 per cent; $15 to $20 per ton, 20 per cent; over $20, 25 per cent.

Frequently, clauses are introduced in the contract covering the question of forfeiture or abandonment of the work, so that there may be included a specification that a certain minimum amount of work shall be done each year. The ownership of plant or improvements erected upon the mining premises, the disposal of the dumps remaining on the property; that is, the time allowed to lessee in which to dispose of his ore after the expiration of his lease; the size of workings, such as shafts and drifts and other regulations covering mining, are in a definite lease all carefully considered and an equitable contract is drawn up.

There are no hard and fast or accepted rules which a standard lease may be said to follow. Mining customs vary greatly, and what may be considered a proper stipulation and agreement in Cripple Creek may provoke considerable criticism in Grass Valley.

The following is a specimen form of a mining lease:

A SPECIMEN MINING LEASE

This Indenture, Made this ..... day of ..... A. D., 19... *between* ..... of ....., lessor, and ..... of ....., lessee:

Witnesseth: That the said lessor, for and in consideration of the royalties hereinafter reserved, and the covenants and agreements hereinafter expressed, and by the said lessee to be kept and performed, ha.. granted, demised and let, and by these presents do.. grant, demise and let, unto the said lessee, all the following described mine and mining property, situated in ..... mining district, county of ....., State of ....., to wit: (Here follows description of the property) ..... Together with the appurtenances, to have and to hold unto the said lessee for the term of ..... from the date hereof, expiring at noon on the ..... day of .... 19...., unless sooner forfeited or determined through the violation of any covenant hereinafter against the said tenant ..... reserved.

And in consideration of the said demise the said lessee does covenant and agree with said lessor as follows, to wit: To enter upon said mine or premises, and work the same in the manner necessary to good and economical mining, so as to take out the greatest amount of ore possible, with due regard to the development and preservation of the said premises as a workable mine, and to the special covenants hereinafter reserved. (Here insert special conditions and agreements of lease, work to be done, royalties and other reservations.)

In Witness Whereof, etc., the said lessor and lessee have hereunto set their hand and seal ..... the day and year first above written.

Signed, Sealed and Delivered
in the Presence of

.... [Seal]
.... [Seal]

If it is desired to incorporate into the lease an option covering the sale of the property, the following form of a working bond may be used at the end of the mining lease given above and before the concluding paragraph:

A SPECIMEN OPTION

And in consideration of the foregoing lease and the expenditures to be made thereunder and the well and faithful keeping of the covenants thereof, the said lessee shall have the right to purchase the said premises, together with all improvements, etc., for the sum of ..... dollars ($.....), to be distributed in the following payments: On or before the ..... day of ..... 19...., the sum of ..... to be paid (designate manner and place of payment), and on or before the ..... day of ....., 19...., the sum of ..... (Here insert conditions of payment.)

Time being of the essence of this contract as to such payments, and upon the tender of such payments the lessor will execute, acknowledge and deliver at his own cost, good and sufficient deeds to the lessee, or such person or company as the lessee shall nominate, conveying the said premises clear of incumbrance. (Deeds to the property are generally placed in escrow with some bank or responsible party, to whom payments are made when due under the agreement, and who delivers the deeds when payments are completed.)

The forfeiture, surrender, or termination of the above lease for any cause shall render the option void, and the above mentioned payments may not thereafter be tendered.

It is expressly agreed and understood that this agreement shall be considered as an option to purchase only, and not as obligating the said lessee to purchase said property.

In Witness Whereof, etc. (See close of Mining Lease.)

THE PETROLEUM INDUSTRY

The Overdrilling of Oil Fields

Discontinuation of a Practice Which Results in the Early Exhaustion and Reduced Productivity Of Wells Advocated

Written for *Engineering and Mining Journal*

OVERDRILLING in an oil field—that is, the drilling of too many oil wells in a given area—produces such seriously detrimental results to the field that it should be prohibited by legislation. Its affects are, first, to cause the oil pressure over a much larger area to subside rapidly, necessitating pumping where wells would otherwise have flowed; second, it causes the oil-bearing stratum or strata within the drilled area to be so rapidly exhausted that a maximum recovery of oil cannot be made; third, it usually permits the salt water to break into the field prematurely, and once there it irresistibly encroaches on the area still underlaid by oil-bearing formations, causing producing wells to go to water much sooner than they should under normal conditions, thus greatly lowering the total production of the field. To these losses must be added the big expense of drilling wells that are unnecessary for the economic working of the area.

CAUSES OF OVERDRILLING

Following an oil-field boom the control of the land is usually split up among a number of companies, each holding leases on many tracts of small acreage. Drilling on one tract nearly always necessitates offset drilling on others, and when oil is discovered there is a rush to obtain a share of the liquid mineral. As a result, a whole field may be overdrilled in a short time. Many of the north Texas oil fields have been most injuriously affected by this bad practice. Burkburnett may be cited as a specific instance of an entire field being in considerable degree harmed through overdrilling.

A different situation appears to be developing at West Columbia, Brazoria County, Tex. The area referred to is a fifty-acre tract lying over a mile northwest of the main field, and although it cannot now be said that this area is overdrilled, the development work under way appears to indicate that it may be in the near future. The history of this small outlying tract is unusual. On July 30, 1920, the Texas Co. brought in its No. 1 Abrams well, on the Abrams lease tract of about 1,380 acres, and about a mile northwest of the main field. The well came in flowing approximately 15,000 bbl. of oil daily, and later increased to a maximum of about 27,000 bbl., from which it later declined to 7,500 bbl. It is rumored that the Texas Co. was not "ready" for this well to be brought in, and the whole crew was discharged.

THE RUSH FOR LEASES

Naturally, this great oil discovery created a new demand for leases, and lease bonuses, even on areas a considerable distance away, rose abnormally. But the only "close-in stuff" consisted of a fifty-acre patch on the north edge of the Abrams ground at a distance of nearly a quarter of a mile north of the Abrams well. Nine different companies, exclusive of the Texas Co., each acquired part of this area, the Humble Oil & Refining Co. holding the largest part, or eighteen acres.

Six companies immediately began drilling as fast as derricks could be built and rigs hauled to the ground. Already the Humble company has completed two wells, the first making an initial production of 1,000 bbl. and the second 1,500 bbl. daily, and is drilling a third. The Monarch Oil & Refining Co. has completed one well making 1,000 bbl. initial production, and is drilling a second well, and the Gulf Production Co. has completed its No. 1 Masterson well, which came in flowing at the rate of 10,000 bbl. per day for a short time, soon sanded up, and later came back flowing 2,000 bbl. daily. In addition to these wells several others are being drilled on the tract, and immediately across the line to the south the Texas Co. is already drilling two offset wells.

This is an instance where, in a few weeks, almost the maximum number of wells for the economic extraction of the oil from this acreage has been drilled or partly drilled, and where several oil companies are pitted against each other in an effort to obtain the maximum amount of oil possible in the shortest space of time. It presents a condition that will almost inevitably lead to overdrilling, and which can be averted only by agreement among the companies or by state or national regulation. Already water in large quantity has appeared in the Monarch company's well. This well has been killed and will be cemented, as it is believed the water is coming in from the bottom.

If this small acreage were the entire field, the damage by overdrilling here would not be so serious, but, as pointed out, the life of the entire field, or at least much of it, can be shortened and the total production reduced by this bad practice. By all means let there be enacted regulations governing overdrilling.

The Japanese Oil Monopoly

Commercial Attaché James F. Abbott, at Tokyo, advises that no proposal looking toward a Japanese government monopoly of petroleum will be made until parliament convenes in January. While nothing definite has been decided upon, the proposed monopoly is likely to affect all Japanese possessions as well as the oil fields in Japan proper.

Japan produced only about one-half of 1 per cent of the world's crude petroleum in 1919, and its production has shown a steady decline since 1916, when 123,558,416 gal. were produced. The production for 1917 dropped to 119,576,223 gal. and that for 1918 to 102,110,650 gal.

The figures for the full year 1919 are not yet available, but basing estimates on the first nine months' production of 67,737,796 gal., the total production for 1919 will not reach much more than 90,000,000 gal.

The oil monopoly is being proposed largely to guarantee supplies for the navy, and new wells have been bored at Nairya and Kosenho, in Formosa, with rather

indifferent results. The Echigo fields, which produce about 60 per cent of Japan's supply, showed a decline of about 10 per cent in production during 1919. Decline in production is attributed somewhat to increased difficulty of importing well-boring apparatus since the armistice, and this has undoubtedly impeded the development of new resources.

Bureau of Mines Petroleum Experiment Station at Bartlesville, Okla.*

Investigations by Oil Technologists Cover Wide Scope And Are of Great Assistance to Operators Engaged In Production and Refining of Petroleum

THE Secretary of the Interior in the early part of 1918 approved the establishment of the Petroleum Experiment Station at Bartlesville, Okla., upon the condition that the city furnish the site and guarantee $50,000 for the erection of the buildings. A site of five acres and the necessary construction fund were furnished by the Bartlesville Chamber of Commerce.

The buildings consist of an administration and laboratory building, both of brick construction. The former is a two-story structure of eight rooms. A large room occupying over half of the main floor is devoted to the library, reception room, and clerical force. The remaining rooms comprise a drafting room and six offices occupied by the staff assigned to this station. The laboratory is a one-story brick building and contains a well-equipped chemical and physical laboratory; also a machine shop and mechanical laboratory. In addition to the main buildings there now are on the property an experimental refinery, a blueprint house, and a storehouse. These latter buildings are all of sheet-iron construction.

Oil-Field Development Problems

The petroleum experiment station at Bartlesville was established by the Bureau of Mines for the purpose of co-operating with those actively engaged in the petroleum industry. It might be termed a laboratory for practical research and for solving problems, devising new methods, preventing wastes, effecting economies, and for collecting and disseminating information. Investigations are not limited to any one branch of the industry nor to any one part of the country. Wherever opportunities appear for increasing efficiency, whether in the drilling of wells, in the producing or transportation of oil and gas, in the storing, refining or utilization of oil and its products, they may be considered. With the funds available, an effort is made to select problems in which a maximum number in the industry will be affected, and it is not possible to work on minor problems of interest to one company only.

Congress provides $25,000 annually for salaries and operating expenses of the station. In addition, certain men are headquartered there and are paid from other funds, so that the Government appropriates annually close to $35,000 for support of the station. At present it receives an annual appropriation of $12,500 from the State of Oklahoma. In addition, during 1920 the Bureau received $1,000 from the Ardmore Chamber of Commerce for continuation of an investigation in the Hewitt oil field, near Ardmore, Okla., thus making a total of approximately $50,000 which is expended each year through this station. This money provides for fifteen employees, ten of whom are technically trained men.

With its limited personnel and funds, the Bureau has considered that in connection with oil-field development problems the greatest benefit can be derived by working up a new field and turning the results of the investigation over to the operators and then moving to another new field. This work consists of gathering available information, making maps showing well locations and elevations, structure contour maps, geologic cross sections, peg models, and similar work, all of which helps to reveal the underground conditions of the oil fields. From these the stratigraphic location of the oil, water, and gas sands is determined, so that it is possible to predict the proper depths for landing casing to keep the water from the well and to avoid drilling too deep. By a study of the casing depths in wells already drilled, it may be found that water cased off may have access to upper oil or gas sands, thereby doing great damage. Likewise it may be discovered that an oil or gas sand has been cased off behind the pipe, and that the oil or gas is migrating between the wall of the hole and the pipe into barren sands, or sands where the oil, gas, or water is under less pressure, where it is wasting. This work often demonstrates the manner in which corrective measures may be applied; also, how to avoid wastes in the future. It includes a study based on engineering principles for increasing production, conserving oil and gas, and the economic development of the field. This work is of an educational nature, with the object of pointing out to the operators the advantages to be derived by applying engineering principles to underground operations. The Bureau engineers have worked on the Comanche, Walters, and Hewitt oil fields. An investigation of the underground conditions in the Walters oil and gas field was completed in the early part of the year, and a report made up and distributed through the Bartlesville Chamber of Commerce. Recommendations were made on efficient methods of operation, designed to increase the ultimate production of this field.

It is conservatively estimated that approximately 80 per cent of the oil remains in the sands and is not recovered by present production practices. Too little attention has been given to the proper methods of increasing the production in old wells and for learning best production practices under varying conditions to obtain a greater recovery. An investigation is being made covering both natural and mechanical factors affecting production, with the object of ascertaining methods which may be of value for increasing the percentage of oil recovered from the oil sands.

Evaporation Losses Investigated

An extensive investigation of the evaporation losses on Mid-Continent crude oils has just been completed, and the information so obtained will be published by the Bureau of Mines. As a continuation of this, work will be carried on to devise practical means for preventing and saving the evaporation losses. These particular losses can be materially reduced at a nominal cost, and the problem is now being attacked so as to provide practical means for avoiding the bulk of this waste.

During the last year the Bureau of Mines at Bartlesville has done considerable work on the recovery of gasoline from residual gas of compression plants. The

*Abstracted from an article by A. W. Ambrose in *Monthly Reports of Investigations* (October), Bureau of Mines.

report of this investigation has recently been published as Technical Paper 232, of the U. S. Bureau of Mines. In thirty compression plants in Oklahoma there was found to be an average of 0.337 gal. of gasoline per thousand cubic feet. This amounted to more than 5,000 gal. of gasoline a day that was not recovered by these plants. Following this investigation certain recommendations were made to some companies, which installed equipment at a nominal cost that perhaps will increase the gasoline output of this state practically 600,000 gal. during 1920. It is important to note that this increase will be from residual gases, which heretofore had gone to waste.

REFINERY INVESTIGATIONS OF THE BUREAU

A part of the experimental refinery at the Bureau of Mines station has been completed, and a series of experiments have been started to determine the best operating methods in order to obtain results corresponding to those obtained in large-scale plants; also, to check the efficiency of large-scale operation. It is planned to vary operating conditions to obtain data on the rates of distillation, temperature of condenser, fuel consumption, methods of treating, and like matters.

It is proposed to complete the experimental refinery now in operation at the Bartlesville station; to complete investigations now going on for recovering gasoline from waste tail-house gases and for making cleaner separation between gasoline and kerosene; to carry on experiments on the cracking of light fuel oils in order to obtain more gasoline from the crude; to experiment on methods of reducing refining losses, and to improve the quality of refined products; and to determine if high-grade lubricating stocks cannot be obtained from Mid-Continent crude oils, because of the shortage of lubricating stocks from Pennsylvania oils. In general, the purpose of these investigations is to increase the recovery of the more valuable products from crude oil and to improve their quality, particularly as to the crude oils of Kansas, Oklahoma, Texas, and Louisiana, from which state approximately two-thirds of our present production is obtained.

Queensland Gas Expected To Give Higher Yield of Petroleum

SPECIAL CORRESPONDENCE

In *Engineering and Mining Journal* of Nov. 6, 1920, some particulars were given of the efforts that have been and are now being made to find petroleum at Roma, in Queensland, and of a heavy flow of gas, showing undoubted evidence of petrol, that was encountered last August. Later advices show that this gas, on being tested by the government analyst at a comparatively light pressure, gave 1.2 pints of petrol per 1,000 cu.ft. of gas. When the bore has been further cleared and arrangements have been completed for obtaining a pressure and temperature which are considered in America as giving the best results it is almost certain that the petrol content will be found to be considerably higher.

Some wild estimates have been made as to the quantity of gas that is escaping, and equally inaccurate calculations are being made as to the value of the late development, but these estimates are pure guesses, as nothing has been done to prove the quantity of the flow. In fact the volume of the flow is not considered material, as at present it is occurring only under conditions that are temporary, and can no doubt be increased, possibly to an almost unlimited extent, by further boring. What can be stated, however, is that in America, where petrol is selling at one-third the price now ruling in Australia, large quantities have been profitably extracted from gas carrying no more than 1 pint per 1,000 cu.ft. of gas, and there is little doubt that in the gas at Roma the state has an asset that can at any time be turned to profitable account, even if oil should never be found. This is the opinion of W. E. Cameron, the local government geologist, who has made a special study of the subject and has had charge of the geological side of the Queensland oil prospecting from the inception of the state bore at Roma.

It is a notable coincidence that of four bores put down at Roma—the first two for artesian water—three have become obstructed, and two of them have been abandoned for this reason. When the flow of gas that was lighting the town from No. 2 bore suddenly gave out, and attempts were then made to carry this bore deeper, the hole was found, mysteriously enough, to be choked at several places with some large pieces of solid iron, that defied all efforts to remove it.

Excessive Use of Oil for Ships Opposed by Pirrie

Lord William James Pirrie, chairman of the shipbuilding firm of Harland & Wolff, recently gave out an interview regarding the future of oil as a fuel for sea-going vessels.

Lord Pirrie urged American shipowners to go slow in converting their steamers into oil burners, and said that in view of the present limited supply of this type of fuel it would not surprise him if this Government placed restrictions on the use of oil when other fuels were available.

"Until Mexico gets into a more settled state," said Lord Pirrie, "I feel that there is great insecurity in launching too large a program calling for vessels using oil as a fuel.

"Every possible step should be taken to prevent waste and to conserve the supply. This can only be done effectively by the adoption of the internal-combustion engine. It is, however, a great responsibility for any shipbuilder to advocate this type of propulsion under present conditions, for if oil could not be obtained in the trades in which such vessels were employed, they would be absolutely useless."

French Tariff on Prospecting Machinery Temporarily Suspended

At the request of the French commissary general for motor fuels and petroleum, the Ministry of Finances has just issued a temporary authorization for the free admission of prospecting machinery used in searching for petroleum, writes the *Écho des Mines et de la Métallurgie*. This measure is designed to encourage the initiative of all who desire to take an active part in the exploration of France's subterranean resources with a view to presenting France with a home supply of oil and of the products derived from it.

Photographs From Oil Fields

Copyright by Ewing Galloway, N. Y.

AN OIL TANK FIRE IN THE CUSHING FIELD, OKLAHOMA

The cannon in the foreground was used to shoot through the tank below the blaze lines, thereby lessening the danger of a bubbling that would cause the oil to run over the embankment around the tank and ignite other tanks.

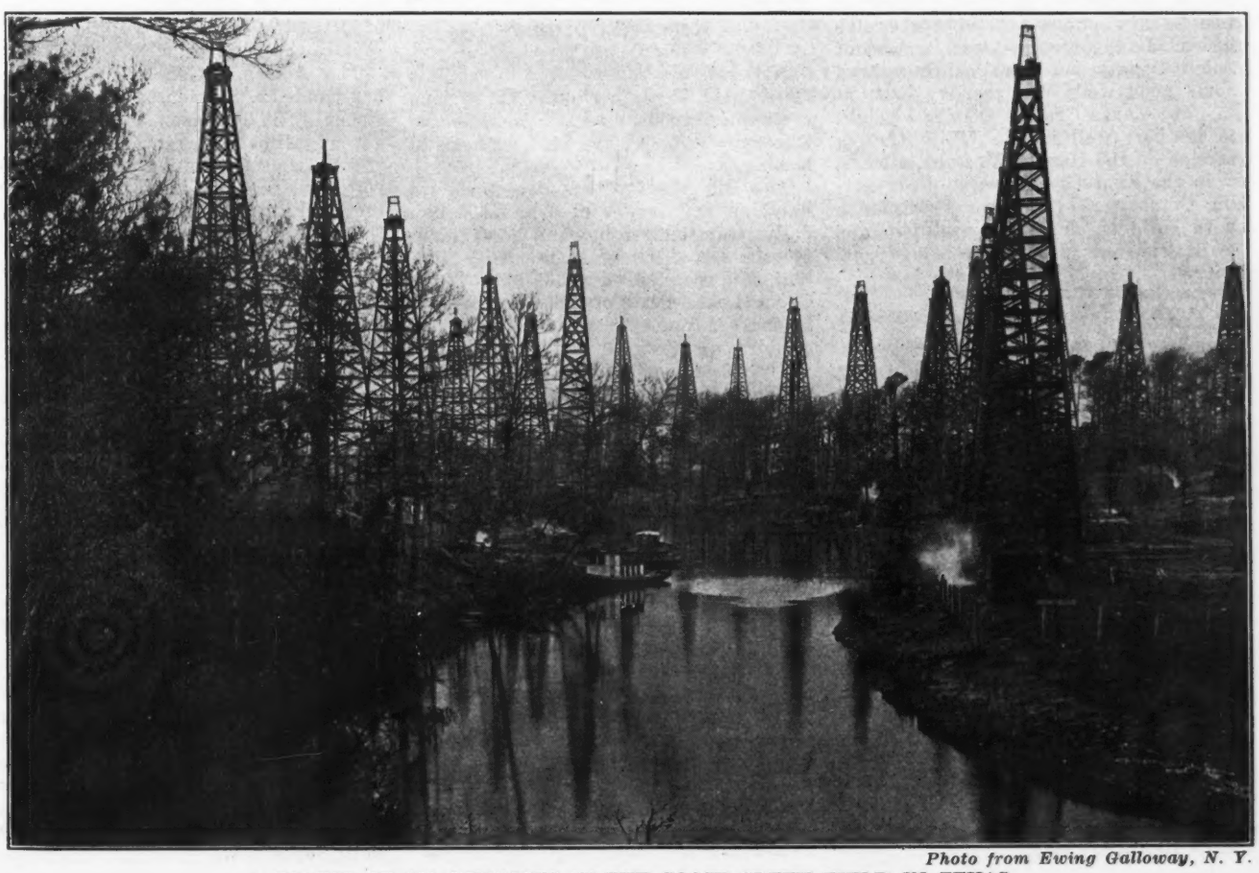


Photo from Ewing Galloway, N. Y.

A FOREST OF OIL DERRICKS IN THE GOOSE CREEK FIELD IN TEXAS

NEWS FROM THE OIL FIELDS

Christian County Takes Place in Kentucky Producing Districts

From Our Special Correspondent

Christian County, Ky., is the newest field to announce development. Two wells have been drilled in the northeast corner to about 400 ft., with a third hole just south of White Plains. The two which are completed will produce about five barrels each. Three wells have been drilled near Crofton, in the northern part of the county, one to a depth of 1,580 ft. and the two others to 600 ft. The shallow ones have a good showing of oil, and the deep well will pump about ten barrels a day. In all there are nine wells recently completed in Christian County, with several rigs expected to move in within the next few months. Wayne County, which was one of the first counties in the state to produce crude oil in paying quantities, has recently brought in a 300-bbl. well.

Well No. 1 of the Future Oil & Gas Co. in Warren County, after being shot, developed into a gusher and is now producing 250 bbl. a day. Well No. 3 on the Whittaker-Kelley lease was shot and 150 ft. of oil stood in the well the following morning. This well is estimated at 30 bbl.

The well of the Major Jones Oil Co., No. 3, on the W. H. Hobbs lease in Lee County, pumped 30 bbl. in twelve hours. In the Mount Aërial section of Allen County activities continue, and some good wells will soon be brought in. The Texas Granite Oil Co. brought in its best well in the White Quarry section on the Harold W. Bublett lease.

In the Kentucky-Tennesse fields during October, 257 wells were completed, with eighteen dry holes and two gas wells, the new production being 8,606 barrels.

Progress Notes From Arkansas

From Our Special Correspondent

The Heilborn Oil Co., of Tulsa, Okla., has let a contract for a well to Messrs. Bewley & Bell, of Little Rock, Ark., to be located in the N. E. ¼ of S. E. ¼, Sec. 30-9-14, Dallas County. Actual drilling started the first week in November.

Home Oil & Gas Co. of El Dorado, Union County, Ark., is to drill on E. ½ of N. W. ¼ Sec. 1-18-16, Union County, Ark. This is the same section on which the Constantin Refining Co. brought in a gas well in May of this year.

The White Oil Corporation is to drill on the N. ½ of N. W. ¼, Sec. 12-18-16. A derrick has already been erected.

Well No. 2 of the Constantin Refining Co., in N. W. ¼ of N. E. ¼, Sec. 12-18-16, cemented 10-in. casing at 1,300 ft. The Arkansas Light & Power Co. is using gas from Constantin No. 1 well for fuel in its El Dorado plant.

Order Defines Royalties on Dominion Petroleum Leases

From Our Special Correspondent

Representations have been made to the Canadian government that owing to the uncertainty as to the amount of the royalty to be paid on the products of petroleum and natural gas locations, under dominion leases, development was retarded, as investors hesitated to increase large expenditures without knowing what tax might be placed upon the oil. An Order-in-Council issued Oct. 29 modifies the former order of Dec. 3, 1919, which provided that after Jan. 1, 1930, royalties might be fixed by the government from time to time, by enacting that for a period of five years after the date upon which the Minister of the Interior may decide that oil in commercial quantity has been discovered the royalty shall not exceed 5 per cent of the output, or the sales of the products of the location as may be decided by the minister, nor less than 2½ per cent of such sales; that for a further period of five years the royalty shall not exceed 10 per cent of the sales of the products of the location, nor be less than 5 per cent, and that thereafter the royalty shall be 10 per cent of the sales.

Wyoming Operators Anticipating Reserve Opening

From Our Special Correspondent

New rigs are being placed in the Salt Creek field, Wyoming, daily by various companies, to be ready to drill if the Government opens the reserve area to leasing.

The Big Muddy field pipe lines are handling an average of over 5,000 bbl. daily from the following companies: Merritt Oil, 3,100 bbl.; Ohio Oil, 1,160 bbl.; Midwest Refining, 345 bbl.; Texas Co., 150 bbl. Parts of these productions belong, through lease ownership, to other companies.

The Petrogras Corporation reports the sale of all its holdings in the Dry Piney field, Lincoln County, to Clinton & Lackey, who have started drilling. The Petrogras Corporation is acquiring leases in the Osage field.

A well of the Pyramid Oil Co. in the Fossil field of Lincoln County has just been completed and is now standing full of oil. The well will be bailed as soon as storage capacity is provided.

The first test of the Producers & Refiners Corporation in the Williams Park district, Routt County, Col., has proved dry at a depth of 1,200 ft. It is probable that the well will be abandoned and a second well drilled elsewhere on the 16,000-acre lease. This land is twenty miles southwest of Steamboat Springs on what is known as "Twenty-Mile Dome."

Texas First Oil Producing State During October

From Our Special Correspondent

During October Texas produced at the rate of over 350,000 bbl. of oil daily and advanced to first place among the oil-producing states. The big gain is due largely to the two great Texas Co. wells at West Columbia, Brazoria County, and the north-extension wells of that field, and to the general gain all over Stephens County, especially in the Breckenridge district. Stephens County is now the leading oil-producing county of the state. The total production for the month would have been larger if lack of storage and transportation facilities in the Breckenridge field had not necessitated slowing down of drilling operations.

The United States Shipping Board has accepted the bids of the Texas Oil Co., of New York, to furnish one year's estimated supply of lubricating oils, amounting to 2,770,870 gal., at prices ranging from $0.47 to $0.78 per gal. Deliveries are to start at once and are to be made at Atlantic and Gulf ports.

The Gulf Export & Trading Co. lost its barge "Ankla" near Tampico in the recent Gulf hurricane, while in tow of the seamer "Colonel Roosevelt." Both boats were blown ashore, but the steamer was refloated. Another barge of 1,100-ton capacity will be built to replace the one lost.

The Attorney General's department has handed a decision to Land Commissioner J. T. Robinson that all oil and gas royalties and rentals received on "State Land" consisting of islands, saltwater lakes, bays, inlets, marshes, and reefs within tide-water limits and the Gulf, shall be divided, two-thirds to the permanent school fund and one-third to the general revenue fund. Also that royalties and rentals on land belonging to the permanent fund of the University of Texas shall be apportioned to that institution.

A spectacular fire occurred in the West Columbia oil field on Nov. 2, when the gas escaping from the Texas Co.'s No. 51 Hogg well became ignited by the heat generated by friction. The reflection of the fire in the sky could be seen for over fifty miles. This well, 300 ft. from the flow pit of the No. 49 Hogg well, blew in unexpectedly at 2,254 ft. The No. 49 Hogg is flowing thousands of barrels of oil daily, but it was saved from ignition.

Blue Ridge, Fort Bend County, is still of paramount interest on the Gulf Coast, and the scramble for leases continues, although the big well of the Texas Co., west of the dome, choked and quit flowing after having been pinched down to 500 bbl. daily. Storage facilities will now be provided and the well cleared.

Book Reviews

A Textbook of Geology. Part I. Physical Geology. By Louis V. Pirsson. Second, revised edition. Cloth; pp. 470; 6 x 9. New York. John Wiley & Sons, Inc., 1920. Price, $3.

This noteworthy volume puts in its appearance after the death of the able author, whose preface is dated May, 1919. It is a fitting memorial, and we recommend it for the use of colleges and schools, and for the general reader who desires a grasp of geologic thought. The language of the book is delightfully clear, unnecessary technical words are omitted, and those which are used are carefully defined: yet the treatment is painstaking, thoughtful, and thorough. If any one wishes to be inducted into the principles of geology, this is decidedly the book to recommend. The principal geologic processes, so far as worked out by investigation, are explained thoroughly and patiently.

The author, himself known principally as a petrologist, has not emphasized the igneous rocks especially in this volume: possibly he has leaned over backward a little in this respect, and emphasizes somewhat the simple and picturesque phenomena of physiography, glacial geology, and the other divisions of what has been humorously called "superficial geology." A conservative and judicial attitude is maintained in the presence of conflicting views concerning any problem, as is fitting in the case of a textbook. The author has, rather, the habit of observing, after citing divergent views, that the cause of the phenomenon in question is probably complex, and that each explanation may apply in different cases. We are inclined to regard this in several instances as undue optimism, and to believe that in most instances one or the other of the views is correct and the other wrong.

A textbook is a difficult thing to manage, on account of the vast ground to be covered and the necessity of familiarity with each division. The chapter on ore deposits is perhaps unduly short (forty-three pages). Possibly the author has gone as far as the scheme of the volume warrants, but the student or reader will need other literature to form any adequate idea of ore deposits.

Certain ideas which are textbook habitués and are borrowed from one to the other are inevitable, especially in a book written by a university professor. An example of this is the reproduction, in a modified form, of the diagram originally published by Leconte (p. 377) showing the origin of the Sierra Nevada, the Wasatch Range of Utah and the intervening desert ranges, as the result of relatively recent collapse into faulted blocks of a great arch or geanticline which, before the collapse, reached over this whole span. Now, it is well known that the Sierra Nevada fault-block originated as early as the close of the Cretaceous, and has been repeatedly subdued by erosion and uplifted again, since that time: so that the broken-arch theory is quite without foundation and opposed to facts.

No study is more essential to general culture than geology, as taught by a volume of this admirable type. The study should be a prescribed one, not only in universities, but in preparatory schools. It is more essential to a general education than many of the subjects at present prescribed. J. E. S.

The Mineral Industry. Its Statistics, Technology and Trade During 1919. Edited by G. A. Roush and Allison Butts. Cloth, 6½ x 9½; pp. 902. McGraw-Hill Book Co., New York. Price, $10.

The twenty-eighth volume of this important book has just been issued. Like the previous volumes it contains comprehensive reviews of about fifty of the most important mineral industries during the year covered. Statistics for preceding years are also given. The information presented is international in character, though, being an American publication, of course domestic activities receive the most space. It is an extremely handy reference book, largely a condensation of published statistics and technical information.

E. H. R.

Technical Papers

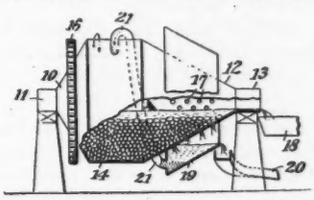
Talc—The method of mining and milling employed at the talc deposits of George H. Gillespie & Co. at Madoc, Ont., is described in the U. S. Bureau of Mines *Reports of Investigations*, Serial No. 2,162, five pages. It may be obtained by addressing the Bureau at Washington, D. C. Bolting through silk cloth is successfully done at this mill.

Theory of Flotation—In the August issue of the *Journal of the Chemical, Metallurgical and Mining Society of South Africa* (Johannesburg, price 3s. 6d.) is published a seven-page article entitled "A Résumé of Literature on the Theory of Flotation, With Critical Notes." The phenomenon of flotation cannot be said to be understood, but this article gives a good summary of the opinions held by writers on the subject.

Philippine Mineral Resources—The Bureau of Science of the Philippine government, at Manila, has issued a 75-page illustrated booklet entitled "The Mineral Resources of the Philippine Islands for the Years 1917 and 1918." The principal mineral products are gold, coal, sulphur, asbestos, and manganese. Iron and asphalt may exist in commercial quantities. Much of the archipelago is unexplored, and the known mining fields are undeveloped. Foreign capital is required. The pamphlet would be much easier to look over if the pages had been cut. The illustrations, on heavy paper, are particularly clear, though at least two are printed upside down.

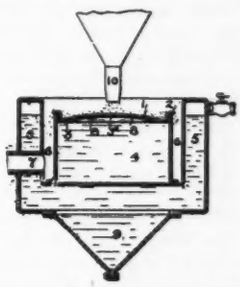
Recent Patents

Conical Mill—No. 1,355,474. Harry W. Hardinge, New York, N. Y. Perforations are made in the conical part of a Hardinge mill through which the pulp discharges into an outer drum, rotating with the mill. The fine material



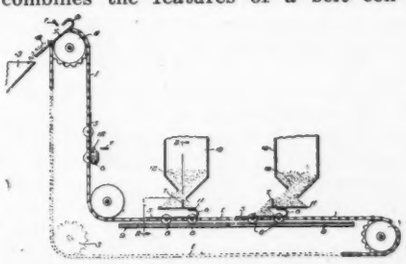
overflows from this drum and the oversize is returned to the mill for further reduction.

Concentrating Jig. No. 1,354,550. Georg Glockemeier, Luderitzbucht, South Africa. A jig with a sieve



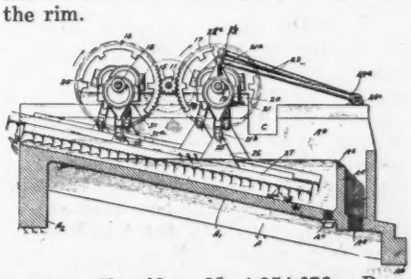
domed upward and a concentrate discharge in an annular zone near the center.

Conveyor—No. 1,355,180. David W. Starkey, Chicago, Ill. A system which combines the features of a belt con-



veyor and a bucket elevator, as shown in the illustration.

Thickener. No. 1,355,071. Charles Allen, El Paso, Tex. This type of Allen cone has a float, actuated by the density of the pulp, which controls the amount of discharge passing over the rim.



Drag Classifier. N. 1,354,676. Benjamin A. Mitchell, Garfield, Utah. An apparatus of the Dorr type with a different mechanism.

ECHOES FROM THE FRATERNITY

Mining and Metallurgical Society Gold Medal Awarded to E. A. Cappelen Smith

A. L. Walker and H. F. Guggenheim Discuss Life and Work of Chuquicamata's Master Metallurgist

The award of the Mining and Metallurgical Society gold medal for the year 1920 was made to E. A. Cappelen Smith for distinguished service in the art of hydrometallurgy on Wednesday evening, Oct. 10, at a dinner held at the Hotel Commodore in New York, in the presence of over 150 members, guests and their families. The toastmaster was Dr. E. P. Mathewson, and speeches were made by Dr. Arthur L. Walker and Harry F. Guggenheim, and on the presentation of the medal by Waldemar Lindgren, president of the society.

Dr. Walker told of the coming of Mr. Smith to this country from Norway, his native country; his wanderings, following his profession as a metallurgist, to Anaconda and other parts of the West; then finally back to the East Coast; how he built up a reputation as a progressive and courageous metallurgist, which finally led to his being selected to solve the treatment problems of the great Chuquicamata orebody, in Chile. Dr. Walker's speech was freely interspersed with witty remarks and kept the audience in good humor during the not too circumstantial account of Mr. Smith's professional history.

Harry F. Guggenheim sketched briefly and vividly the fact that the ore deposit at Chuquicamata had been known for hundreds of years; that it had first been worked by the Incas and, after the conquest, by the Spaniards; that the rich ores had been exhausted, and though the color of the rock proclaimed to every comer "Here is copper," it awaited the touch of adventurous science to transform the desert into the abode of industry. This had been accomplished by the scientific staff of M. Guggenheim's Sons, and in this the solution of the metallurgical problem by Cappelen Smith was one of the most important features. As the result, plants capable of treating 10,000 tons of ore a day, from an ore reserve that would last over a hundred years, have been constructed; 4,000 workers are employed in the enterprise; and a modern mining town had taken the place of the empty waste. In short, Mr. Guggenheim remarked, a soul had been born in the desert.

Mr. Lindgren, in presenting the medal to Mr. Smith, acknowledged his own unfamiliarity with metallurgy, although he claimed once to have, by superhuman efforts, kept a lead furnace running for three days. "Eventually," he remarked philosophically, "she froze."

In accepting the honor conferred by the society, Mr. Smith displayed both modesty and humor, pointing out that the achievements at Chuquicamata had been the result of enthusiastic team work on the part of the staff, under the captaincy of Pope Yeatman, and recounting some of his experiences since coming to the United States. He paid a feeling tribute to the equal opportunity and generous appreciation given foreigners in this country, only provided they would work. He had found it difficult to convince people that he had not changed his name from what it was in Norway; and had noted with amusement the struggles of his friends in this country with the geography of Europe. He had been dubbed "Swede Smith" in Anaconda, to distinguish him from the rest of the family; and finally, as a concession to his tales about the rugged mountains of his native land, "that Swede from Switzerland."

GOLD MEDAL OF MINING AND METALLURGICAL SOCIETY OF AMERICA

At the speakers' table, besides the above mentioned, were G. P. Bartholomew and Dr. R. H. Richards.

Site for National Academy of Sciences Building Secured

National Research Council Will Have Share in the Home To Be Built by the Carnegie Corporation

A site for the new building in Washington which is to serve as a home for the National Academy of Sciences and the National Research Council has recently been obtained. It comprises the entire block bounded by B and C Sts. and Twenty-first and Twenty-second Sts., N. W., and faces southward on the Lincoln Memorial in Potomac Park. The Academy and the Council have been enabled to secure this site, costing about $200,000, through the generosity of about twenty friends and supporters. Funds for the erection of the building have been provided by the Carnegie Corporation of New York.

American Engineering Council Representatives Named by A. I. M. E.

F. A. E. S. Membership Increasing But A. S. C. E. Decides To Stay Out

At a meeting of the executive committee of the American Institute of Mining and Metallurgical Engineers on Oct. 28, 1920, the following were designated as representatives of that institute on American Engineering Council: Herbert C. Hoover, J. Parke Channing, Arthur S. Dwight, Edwin Ludlow, Allen H. Rogers, Philip N. Moore, J. V. W. Reynders and Joseph W. Richards.

At its recent regular meetings the Grand Rapids Engineering Society, of Michigan, accepted the invitation to become a charter member of the Federated Societies; and the advisory council of Iowa Engineering Society made unanimous recommendations that that society also accept. The council designated J. H. Dunlap as its representative to the meeting of American Engineering Council in Washington, D. C., Nov. 18, 19 and 20.

The American Society of Civil Engineers' referendum on the question recently decided by 3,300 to 2,300 to refrain from becoming a charter member of the Federated American Engineering Societies. Already seventeen organizations have definitely accepted charter memberships and more than forty-five representatives are entitled to seats on American Engineering Council.

Utah Chapter of A. A. E. Hears C. J. Ullrich at Annual Banquet

About two hundred engineers of Salt Lake and other Utah cities attended the annual banquet of the Utah Chapter of the American Association of Engineers in Salt Lake City, Utah, Oct. 17.

W. A. Richmond, president of the Utah Chapter, was master of ceremonies and introduced C. J. Ullrich, assistant state engineer, who spoke on the growth of the American Association of Engineers from its first meeting in 1915 until today, when it has a membership of 21,000. It is dedicated, he said, to service—service of the engineering profession, of the community, and of the nation. Its purpose is unity.

A Copy of the Temporary Mining Laws of Persia, dated Oct. 2, 1917, is in the hands of the U. S. Bureau of Foreign and Domestic Commerce, Washington, D. C. *U. S. Commerce Reports* for Oct. 22, states that it will be made available on applying to the bureau or its district co-operative offices and referring to File No. NE-15.

COURT DECISIONS IN MINING CASES

By Wellington Gustin

Maine Courts To Adjudicate Arizona Conversion

Claims of Arizona Commercial Mining Co. Against Iron Cap Copper Co. Before Supreme Judicial Body

Two Maine corporations operating mines on contiguous claims in Arizona have taken their controversy over ore into the Supreme Judicial Court of Maine. The same controversy was first brought into the Massachusetts courts, and after hearing there dismissed because the parties were non-residents.

In the suit the Arizona Commercial Copper Mining Co. alleges that the Iron Cap Copper Co. has taken, converted, and sold some 250,000 tons of its ore and asks for the money had and received by the defendant for same.

Complainant's bill charges the Iron Cap Co. with taking the ores during the preceding six years by way of the Iron Cap shaft, the Williams shaft, and other shafts on the property occupied by the latter, and underground workings, said ores coming from those portions of the veins, lodes and ledges which had their top or apex upon the mining claim owned by the complainant, and wholly within the complainant's surface lines, such veins, lodes, or ledges being at the time in the actual possession of complainant.

Defendant denied that it had taken any ores except those extracted from veins, lodes, and ledges in Arizona, as to which it has in good faith at all times openly and to the knowledge of complainant claimed title and ownership; and contended that the workings and all means of access thereto have been in the exclusive occupation, possession, and control of the defendant.

The court said that in Maine the landlord owns all within the limits of his land from the center of the earth to the high heavens. His bound areas are planes produced by projecting his boundary lines vertically downward and upward. But in the case of mining claims derived from the public domain the boundaries are governed by the "apex law" (Rev. Statutes U.S. 2322). This law is stated to be that one who secures a mining claim on a public domain is entitled not only to the exclusive enjoyment of the surface but to all veins and lodes throughout their entire depth, the top or apex of which lies inside the surface lines, although such veins and lodes may so far depart from the perpendicular in their course as to extend outside the vertical side lines of the surface location.

On the question of the court's jurisdiction it was said that no suit can be maintained in one state to determine directly the title to real property in another state. But the Maine courts have jurisdiction of a suit between Maine corporations arising out of conversion of ore in Arizona where title to the land was only incidentally involved and the action, being one for money relief, was transitory.

The court found that the complainant presented a good cause of action against defendant.

California District Court Dismisses Government's Bill

Holds Development Work of Oil Companies Was Made in Good Faith—Work on Claim for Benefit of Group Sufficient

In the suit of the United States against the Standard Oil Co., Syndicate Petroleum Co., Pyramid Oil Co., and a number of others, to restrain waste and depletion of the oil contents of certain California oil lands included in the area described in the Presidential withdrawal order of Sept. 27, 1909, the District Court dismissed the Government's bill. No discovery had been made at the date of this withdrawal, but the court finds that defendants were bona fide occupants or claimants of the property, diligently searching for oil at that time, and therefore protected by the saving clause of the Pickett Act (Comp. St. No. 4523-4525). It found that at the date of withdrawal defendant had twenty-four strings of tools in operation, as many as the available water supply would permit, had expended in developing and preparing to develop the property $500,000 and had 183 men on its payroll and $280,000 worth of tools and materials on hand, $36,000 of which was received and unloaded on the day of withdrawal. Its operations were continued unceasingly after the withdrawal date, the force was increased, additional material assembled, the water plant enlarged and extended along with completion of gas mains and telephone system, and defendant prepared for the drilling of twenty additional wells, prosecuting all such work to a discovery of oil.

No work was being done on the identical quarter section of land in controversy at the time of the withdrawal; but the court was convinced that the work being done on the contiguous claims was intended to and did directly benefit all the claims.

The established law respecting such claims was stated to be "that where two or more contiguous ones are held by the same person or persons work done in good faith upon any one of them, or outside the boundaries of either of them, which directly tends to the development or benefit of all of the claims for mining purposes, should be held applicable to each and all of such claims." (245 Fed. 523.)

Loses Suit Against North American Oil Consolidated

California Lands Held Valid Locations Prior to President's Order of Sept. 27, 1909, and Protected by Pickett Act

The United States Circuit Court of Appeals, Ninth Circuit, has affirmed the decree of the District Court for the Southern District of California, dismissing the suit by the United States against the North American Oil Consolidated, Pioneer Midway Oil Co., the Union Oil Co. of California, and the Producers' Transportation Co., and a rehearing was denied the Government.

The Government had sought a decree adjudging that the defendants had no right or interest in a certain section of the then public land of the United States known as Section 2, Township 32 South, of Range 23 East of the Mount Diablo base and meridian, or in any of the oil, gas, or other mineral contained therein, for the appointment of a receiver of the property, or for an injunction and an accounting.

The court found that the lands involved were valid locations under the mineral land laws at the time the President made the withdrawal order of Sept. 27, 1909 (36 Stat. 847) and were therefore excluded from such order, and, further, that the lands and their contents were protected by the Pickett Act

Missouri Court Disallows Claim of Breach of Warranty

Judgment against the Adams-Hicks Zinc & Lead Corporation for the full sales price of shells sold it by the Central Foundry Co. has been affirmed in the Missouri Court of Appeals in Springfield. The shells were bought for use in its mining plant as part of the machinery for crushing mineral-bearing rock. The mining company alleged that these shells were sold to it under a warranty that such shells would each crush not less than a specifield number of tons of rock, and agreeing to make reductions in the price in proportion to any failure in that respect.

The mining company filed a counterclaim for the alleged failure of the warranty as to the shells or rolls. The jury denied these claims and gave verdict for plaintiff for the full purchase price as agreed. The agent selling the rolls testified that he made no representation or warranty as to the shells crushing any particular amount of rock. The mining company appealed from the holding of the trial court that the burden of proof was upon it to prove that the seller warranted the shells sold to buyer would each crush the quantity of rock as claimed by it. This holding was affirmed on the appeal.

MEN YOU SHOULD KNOW ABOUT

C. L. Graves, mining operator of Cusihuriachie, Mexico, has been to Chicago for two weeks on business.

J. T. Pardee has returned to Washington after making a geologic study of glacial placers in western Montana.

Eugene Stebinger again is in Washington after an extended visit to Bolivia, where he did geological work.

F. C. Calkins has returned to Washington after several months' field work in the Cottonwood district of Utah.

F. Leslie Ransome is on his way to Arizona for several months' field work in the Oatman and other districts in that state.

George C. Martin has completed geologic field work in the mining region on the Kuskokwim and lower Yukon rivers, Alaska.

L. M. Prindle has completed a study of the geology of the Bennington and Hoosick quadrangles for the U. S. Geological Survey.

William B. Milliken, mining engineer, and graduate of Colorado School of Mines, has an office in Mining Exchange Building, Denver, Col.

S. H. Cathcart, who spent the field season investigating the mineral deposits of Seward Peninsula, Alaska, has returned to Washington.

Anna I. Jonas has returned to Washington after having made a study of the limestone in York County, Pennsylvania, for the U. S. Geological Survey.

John H. White, field engineer for the American Metal Co., Ltd., of London and Denver, Col., was in Reno, Nev., for several days the last of October.

E. E. McCarthy, of New York, an official of the Yukon Gold Co., recently visited the company's dredge operating on Prichard Creek, near Murray, Idaho.

C. E. Van Ostrand has returned to Washington after having taken records of deep temperatures in thirty-four oil wells in Wyoming, California, and Texas fields.

Ernest N. Patty, of the Washington State Geological Survey, has been investigating some manganese deposits in the Olympic Range of northwestern Washington.

Wilbur A. Nelson, State Geologist of Tennessee, was in Washington recently in connection with the economic survey which is being made of the basin of the Tennessee River.

Ira B. Joralemon, of Bisbee, Ariz., geologist of the Calumet & Arizona Mining Co., passed through El Paso, Tex., recently from examining mining properties in Mexico.

Wm. H. Paul, mining engineer of New York City, formerly in Chihuahua, is now in charge of chrome mines in Guatemala controlled by United Fruit Co. interests. His address is Guatemala City.

Lapsley W. Hope has resigned his position as superintendent of the Eureka-Holly Mining Co., Nevada, to accept a similar position with the Ocoee Copper Co., at Ducktown, Tenn.

F. W. Draper, general manager of the Louisiana Consolidated Mining Co., of Nevada, has returned to the mine at Tybo after spending a month in New York in consultation with the directors.

George Clothier, government mining engineer of Stewart, B. C., has returned from his final tour of the Salmon River section, Portland Canal Mining Division. He now is preparing his annual report.

Col. H. H. Yuill, of Bainbridge, Seymour & Co., mining engineers, 645 Salisbury House, London Wall, London, returned to England about Nov. 1, after his trip to examine properties in British Columbia.

Dr. J. W. Beede, professor of geology in the University of Texas, has returned from the Mackenzie River valley, where he spent the summer prospecting in the interest of independent oil operators.

Herbert Hoover and **Theodore Hoover** will move their San Francisco offices on Dec. 1, from the Mills Building to the Balfour Building. Associated with them are Jas. M. Hyde, David McClure, and H. W. Turner.

F. W. Bradley, of San Francisco, president of the Bunker Hill & Sullivan Mining & Concentrating Co., is at Kellogg, Idaho, where he will remain about two weeks, inspecting the mining and smelting operations of the company.

R. H. Sutton is now general superintendent of a group of mines near Concepción del Oro, Zacatecas, Mexico, for Cia. Minera Nazareno y Catasillas, S. A. Mr. Sutton was formerly assistant mine superintendent for Cananea Consolidated Copper Co., at Cananea.

E. H. Hamilton and **E. A. Anderson**, general manager and chief engineer respectively of the U. S. Smelting, Mining & Refining Co., Midvale, Utah, have been inspecting various processes in use at the Anaconda Copper Mining Co's. Washoe reduction works at Anaconda, Mont.

Prof. G. A. Overstrom, who sailed from San Francisco in September, is now at Tul Mi Chung, Suan Concession, Korea, in the interests of the Seoul Mining Co. Professor Overstrom visited Honolulu and Yokohama on his way to Korea and is not expected to return before January.

Archie H. Jones, metallurgical engineer, of Salt Lake City, Utah, is in New York City on business connected with a large mill that his company has designed for a New Mexico property. Mr. Jones recently organized the A. H. Jones Co., metallurgical engineers, of Salt Lake City, which has taken over the business of Charles Butters & Co.

A. B. McCallum, who a short time ago resigned as chairman of the Research Council of Canada, has been appointed to a professional chair at McGill University, Montreal, Quebec. Dr. McLennan, of Toronto University, is named as Dr. McCallum's successor on the Research Council, which is to be reorganized. His work as a scientific adviser to the British Admiralty during the war attracted wide attention.

SOCIETY MEETINGS

The 1920 Annual Meeting of the American Society of Mechanical Engineers will be held at Engineering Societies Building, 29 West 39th St., New York City, on Dec. 7 to 10. The keynote of the meeting will be Transportation and the foremost authorities in its various fields will discuss its problems. Other engineering problems will also receive due attention.

The Utah Section of the American Institute of Electrical Engineers met on the evening of Tuesday, Nov. 16, in the assembly room of the Commercial Club, Salt Lake City. P. A. Jeanne discussed inductive interference problems, and E. G. Holding, manager of the Holding Electrical Co., spoke on "Early Electrical Experience in Utah." Joseph F. Merrill was chairman of the meeting.

OBITUARY

Robert H. Remington, a junior engineer on the staff of the U. S. Geological Survey, was drowned on Nov. 8 while trying to cross a river on the island of Maui, of the Hawaii group.

Captain Charles Kendall, head mining captain for the Quincy Mining Co., dropped dead at his home on Oct. 26. He was born in Cornwall, England, 65 years ago, coming to the United States when a young man and entering the employ of the Franklin Mining Co. at their Pewabik mine. He went to the Quincy Co. when it purchased the Pewabik property.

Captain Thomas Hooper, a pioneer mining man of the Michigan copper country, died suddenly on Oct. 28, in his 79th year. He was born in Cornwall, England, and came to the United States in 1859, when he entered the employ of the Quincy Mining Co. as a miner. He later took up mine development in Ontonagon County, where he was associated with the Union mines, Ontonagon Silver mine, Nonesuch Copper Co., White Pine Co., and from 1899 to 1906 the manager of the Victoria Copper Co. Since 1906 he had spent his time in mine examination, making his headquarters at his home in Cresco, Iowa.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

LEADING EVENTS

Calumet & Hecla Reduces Wages

Low Prices, Excess Production and High Costs Force Retrenchments in Michigan Copper Country

A 15 per cent reduction in all wages and salaries, effective Nov. 16, was announced Nov. 12 by Calumet & Hecla and its subsidiary companies. The Osceola branch of the Calumet & Hecla at White Pine and La Salle, Mich., will be closed down and the forces of that company's other mines reduced. Low price of copper, limited market, unsold surplus, excess production and costs are responsible, and it is estimated that 1,500 men will be thrown out of work.

Such a step was not taken without due deliberation, but it is the only corrective move that can be made to put the Lake district on a normal basis

Bisbee Deportation Case Abruptly Dismissed

Prosecution of the defendants in the Bisbee deportation cases was ended Nov. 4, when charges of kidnapping, filed last year against 206 men, were dismissed by Judge Sam L. Pattee of the Superior Court at Tombstone, Ariz., upon the motion of County Attorney Robert N. French.

Inability to get many of the deported men to appear as witnesses and the fact that hundreds of Cochise County residents had asked him not to put the county to the expense of further prosecutions, said Mr. French, had made it necessary for him to at last ask for dismissal of the indictments.

The indictments dismissed included 159 men named in the "blanket case," which was to have been started Nov. 8, and individual indictments naming forty-seven defendants. Since the prosecution of the cases was started four of the defendants have died.

Schuylkill Mining Majority Stockholders Win Decision in Arizona Court

The Mohave County, Ariz., Superior Court recently rendered a decision in favor of F. A. Garbutt and the majority stockholders of the Schuylkill Mining Co. in the long squabble concerning the Tennessee mine, which was purchased from the Wallapai Mining Co. in March, 1918. If the minority stockholders under Burke do not take an appeal, which seems probable, this will close the long dispute and bring an early resumption of work in the old mine.

WEEKLY RÉSUMÉ

Calumet & Hecla, because of the continued low copper prices, has cut wages 15 per cent in an effort to bring cost of production nearer sales prices. Dismissal of the Bisbee deportation case was ordered by the Superior Court at Tombstone, Ariz., on Nov. 4. International Nickel Co. has announced a reduction in output amounting to 25 per cent, due to the general business depression in the country, which brings production practically on a pre-war basis. Interstate-Callahan closed down, due presumably to the low price of zinc and a strike at the company's smelting agency, the Grasselli Chemical Co. The Tom Reed Gold Mines Co. has brought suit against the United Eastern Mining Co. over an important apex right. The largest known hoisting engine is now in operation for the Quincy Mining Co. In the Gogebic Range ore shipment has ceased for the season. Labor supply in the Porcupine district, Canada, has become more plentiful. The survey of a railroad location into the Flin Flon district has been authorized by the Manitoba government. A U. S. Government committee declares the erection of a smelter in Alaska inadvisable, because of an inadequate supply of fuel and ores. The Controller of the Treasury has refused to allow further payment on a War Minerals Relief claim after the award of the commission has been accepted.

International Nickel To Reduce Output One-Fourth

Announcement was made Nov. 6, by Vice-President J. L. Agnew of the International Nickel Co., Copper Cliff, Ont., of a twenty-five per cent reduction in the output of the company, or from 4,000 to 3,000 tons of nickel matte per month. One furnace is to be closed down, and the gradual general cutting down of the working force had already begun. Between two and three hundred men, a payroll reduction of $25,000 or $30,000 a month, are affected.

A general depression in business all over the United States is given as the reason for the reduction, and this latest decision of the company practically brings production to a pre-war basis.

Interstate-Callahan Mine Closes for Indefinite Period

The Interstate-Callahan mine closed down on Oct. 31, with the exception of twenty-five or thirty men retained on development work. This action was taken by the company on the request of the Grasselli Chemical Co., purchaser of the zinc product of the Interstate-Callahan, the Grasselli company smelting plants being tied up through a strike. The shutdown is for an indefinite period. The company employed about 350 men.

Tom Reed Sues United Eastern

Apex Rights in Faulted Big Jim Orebody Cause Dispute—Prominent Experts Called—Models Introduced

The suit over apex rights in the Big Jim orebody at Oatman, Mont., brought by the Tom Reed Gold Mines Co. against United Eastern Mining Co. in April, 1919, came to trial on Nov. 8 before Judge T. Elmo Bollinger of the Mohave County Superior Court, Arizona. The attorney for the Tom Reed company is Judge Curtiss H. Lindley, of San Francisco, Cal., and the United Eastern company has retained John P. Gray, of Cœur d'Alene, Idaho.

The dispute between the two companies has arisen through a confusion due to the fault system revealed in the Tom Reed mine, whereby the Big Jim orebody, which was purchased in 1917 by the United Eastern, has been dislocated and its northwestern prolongation has been obscured. A number of elaborately executed mine maps and models have been brought forward in connection with the testimony being heard. The witnesses called include prominent engineers and geologists, such as Andrew C. Lawson, Dr. W. H. Emmons of the Minnesota Geological Survey; H. V. Winchell, Oscar H. Hershey, Albert Burch, Walter H. Wiley, and J. A. Burgess, who is a former superintendent of the United Eastern mine. Testimony by the Tom Reed representatives was heard from Nov. 8 to 11; the United Eastern Mining Co. finished its testimony on Monday, Nov. 15, after which the summing up and the arguments by the two sides were heard. The decision is not to be expected for some time.

Copper Country Now Has Largest Hoist Known in Operation

Quincy Mining Co., at Hancock, Mich., on Nov. 10 placed the largest known hoisting engine in operation at No. 2 shaft. It is a Nordberg duplex cross-compound, condensing, steam hoist, with a total winding capacity of 13,300 ft. of 1⅞ in. steel cable, operating in balance at a maximum rope speed of 3,200 ft.-min. The four engines of the hoist are set at an angle of 45 deg. on a triangular frame with the 516,000 lb. drum at the top. The two high-pressure engines are connected to the crank pin on one end of the drum shaft and the two low-pressure engines on the other end, thus eliminating all vibration or pulsation of the hoisting cable. A

floor space of 60 x 54 ft. is required by the engine, which stands 60 ft. high, and weighs, with the condensing equipment, 1,765,000 lb. Its horsepower will vary from a normal of about 2,000 to a maximum of about 6,500. The building is particularly pleasing architecturally.

Shipping Season Closes on Gogebic Range

The shipping season has been closed for this year by cold weather and snow. On the Gogebic Range the thermometer has been down to 8 deg. F. several days so the ore was freezing in the cars, and the snowfall has amounted to about one foot. At the docks at Ashland, thirty-five miles from the range, the weather is always much milder but the storms have interfered with navigation on the lakes. Considering the delays during the first half of the shipping season the tonnage forwarded this year has been good, not record breaking, but as good as the average of recent years.

The Odanah Iron Co. has received a Presscott-Menominee duplex 6½-in. plunger pump to be driven through herringbone gears by an electric motor. It is to be placed on the seventeenth level of the Ottowa mine, but will not pump to surface.

Flin Flon Railway Survey Authorized

The Manitoba government has given the Canadian National Railways authority to proceed immediately with a survey for a railroad into the Flin Flon mine district north of The Pas. The survey will include an estimate of the cost of construction of the road, to be submitted to the Legislature at its next session. The survey is expected to be completed in three months.

Mukden District Rich in Minerals

The Mukden consular district has an area of about 89,000 square miles, a population of nearly 10,200,000, and comprises the greater part of South Manchuria, the principal trading centers being Mukden, Newchwang, Kirin, and Changchun. The climate is similar to that of Minnesota.

"The mining possibilities of this section of Manchuria are enormous" writes Consul General A. M. Pontius, "but present developments are limited. There have been reported coal, iron, gold, silver, copper, lead, zinc, asbestos, and magnesite. Coal is extensively mined, both by Japanese and Chinese. The Japanese are working large deposits with modern machinery, but the Chinese are still using crude native methods. The Japanese also are developing large deposits of iron ore. Copper ingots are produced at one mine with modern methods. Both alluvial and quartz gold are found in a number of places, but no large mines are in operation. Lead and zinc occur mainly as lenticular masses in limestone.

"Mining is still in a comparatively backward state in Manchuria. With more extended railway and road building it is certain that intelligent and extensive prospecting will be undertaken, and the chances for developing mines and industries allied to mining are good. Capital is needed, and the services of experienced engineers, and with these two prime requisities at hand the future of mining in this district should be bright."

Recent Production Reports

Miami Copper produced 4,582,293 lb. copper in October, compared with 4,549,140 in September.

Arizona Copper produced 2,800,000 lb. copper in October, compared with 3,000,000 in every other month thus far this year.

Cerro de Pasco produced 4,698,000 lb. copper in October, compared with 4,444,000 in Sepember.

Shattuck Arizona in October produced 206,772 lb. copper, 790,149 lb. lead, 39,254 oz. silver, and 436 oz. gold. Copper produced in September was 166,513 lb.

Phelps Dodge smelter at Douglas, Ariz., produced 7,126,000 lb. copper in October, compared with 7,998,000 in September. The Copper Queen yielded 4,366,000 lb. in October, Moctezuma 1,817,000, Burro Mountain 546,000 and custom ores 397,000 lb.

United Verde Extension Mining Co. produced 3,864,756 lb. of copper in October, compared with 3,327,644 in September, and with 3,760,892 lb. in October, 1919.

Utah Copper in October produced only 8,000,000 lb. copper, compared with 8,420,000 lb. in September; this is the lowest monthly production of the company since 1916.

Chino Copper produced in October, 3,933,435 lb., compared with a September figure of 5,161,894 lb.

Ray Consolidated's October output of 3,990,800 lb. of copper falls below its September production of 4,502,000 lb.

Nevada Consolidated produced 3,850,000 lb. of copper in October, compared with its September production of 4,650,000 lb.

Calumet & Arizona produced 2,484,000 lb. of copper during October, compared with 3,038,000 lb in September.

The Bureau of Foreign and Domestic Commerce reports that United States importations of Alaskan products for the month of October, 1920, included:

	Quantity	Value
Copper ore, matte, etc., tons	3,956	.....
Copper contents, lb.	4,984,219	$946,128
Platinum, oz.	17	1,955
Palladium, oz.	83	9,515
Gold ore	.....	282,706
Gold bullion, oz.	40,596	729,785
Silver ore	.....	62,429

North Butte Mining produced 1,390,829 lb. of copper in October, 55,306 oz. of silver, and 82 oz. of gold.

Kennecott Copper produced 10,816,000 lb. during October, compared with 8,878,000 lb. in September, and 9,789,320 lb. a year ago.

Rand Gold Production

The gold output of the Rand for October totaled 662,000 oz. fine, as against 682,000 oz. in September.

Special Australian Letter

Broken Hills Mines Still Idle—North Broken Hill Strong Holding Company

Melbourne, Oct. 18—The Broken Hill mines have not yet resumed operations. The special tribunal has given its decision but doubt exists as to the meaning of several passages, and although both parties have agreed to abide by the award neither side appears willing to give way until the chairman explains the meaning of the clauses in dispute.

Although no productive work was done at the North Broken Hill mine during the twelve months ended June 30, 1920, £68,144 was received from sales of products of previous terms and £37,264 from interest, rents and dividends. A sum of £9,038 was brought forward from previous account, £13,400 was transferred from debenture sinking fund reserve, and £1,498 out of provision for expenditure on a new plant remained in hand, making the available total £49,665, which was appropriated as follows: Debenture sinking fund reserve, £13,333; provision for new plant, £25,000, leaving £11,332 to be carried forward. The assets showed a surplus over liabilities of £469,777, as against £547,492 at the beginning of the term. The company now holds £150,000 worth of shares in the Electrolytic Zinc Co. and £20,000 in British Australian Lead Manufacturers Pty., Ltd. In all, shares in other companies (not included in the assets mentioned above) held on June 30 totaled £356,750.

The Gold Producers' Association, Ltd., sold 100,539 oz. of standard gold in September, including 17,232 oz. sold to manufacturing jewelers during the quarter ended Sept. 30. The average net price (estimated on the month's sales abroad) was £5 4s. 9d. per oz. standard, or £5 14s. 3d. per oz. fine.

The business of the Electrolytic Zinc Co. of Australasia Pty., Ltd., is to be taken over shortly by a limited liability company, which will have a nominal capital of £3,000,000. This reconstruction is being made with the object of extending the company's operations and providing capital for carrying out the agreement recently made with the Mt. Read and Roseberry Mines, Ltd., under which the Electrolytic Zinc Co. will undertake the mining and treatment of complex sulphide ores from the Read-Roseberry properties.

Trail Smelter Receipts

The ore received at the Trail, B. C., smelter during the week ending Nov. 7, 1920 amounted to 11,149 gross tons, distributed as follows:

Mine	Situation	Gross Tons
Florence,	Princess Creek	104
Horn Silver,	Similkameen	48
Iron Mask,	Kamloops	46
Josie,	Rossland	286
Knob Hill,	Republic	41
North Star,	Kimberley	173
Sally,	Beaverdell	40
White Bear	Rossland	61
Company mines		10,350

Special London Letter

Credit Rationing Restrains Mining Ventures—Tin Mines Depressed—Lead Prospect Proved

London, Nov. 2—We are still in the throes of the coal strike, and the whole country is on the tiptoe of expectation as to the outcome of the ballot. South Wales and Lancashire seem opposed to the sliding scale as proposed, though other coalfields are reported to be in favor. The uncertainty created by this position has given a decided check to business. A few of the best-known industrial undertakings are bold enough to appeal to the public for additional capital, but mining companies in need of funds prefer to wait until the position is less obscure. With the rationing of credit by the banks, mining directors are compelled to move cautiously.

The Santa Gertrudis is ready to make an issue of notes—has been prepared, in fact, for some time—but failure cannot be risked. The proposition, however, is an attractive one, and there is not likely to be much difficulty. A further cablegram from the Esperanza reports satisfactory developments in different parts of the mine, but as the values are low relatively to the phenomenal gold and silver content of the Descubridora vein that caused the sensational advance in the price of the shares, the public and market speculators are disappointed. Had there been no Descubridora values the property would still have shown merit.

A few weeks ago I reported certain mineral discoveries in the Peak District of Derbyshire. Further exploration there has uncovered a lead vein, concerning the prospects of which hopeful views are entertained. As the deposit exists under some pleasure grounds, there does not seem much prospect at the moment of its being worked in this particular locality, though its extension is being proved outside the prohibited area.

The tin-mining industry in Cornwall is still in the dumps, owing to the fall in the price of the metal—which, by the way, has recovered several pounds per ton—and the difficulties created by the coal strike. One point is worth noting in connection with the Tincroft. This is a shallow mine, and the workers, in order to enable the company to tide over the present unfortunate position, voluntarily and spontaneously offered to contribute a substantial sum monthly toward making good any deficiency. Since the abolition of the "cost book" system of mining in the Duchy, this is the first instance of such co-operation on record. It is stated that the East Pool and Agar Company, which broke away from the tin ticketing, has temporarily returned to this system of disposing of its produce because the smelters who had been buying its production had ceased to do so. The principal buyers at the ticketings now are apparently Cornish smelting undertakings.

The National Mining Corporation, which, as its name implies, embraces a wide field of operations and has quite a hatful of propositions with which to deal, has issued a statement that there is no intention of making a further call on the shares, which are 10s. paid out of £1. The price is at a discount, largely because of the depreciation in some of the holdings.

The Village Main Reef is a London company owning a number of claims on the Witwatersrand. Last week an earthquake occurred, resulting doubtless from the tremendous excavations that have been made, and the fall of rock was so great that it has been officially decided to close down the mine for good. The profitable ore was all but exhausted, though the gold premium would have permitted operations for a few months longer. The capital is only £472,000, and the shareholders have received over £4,000,000 in dividends.

Queensland Notes

Brisbane, Oct. 15—Operations at the mines and smelters of the Mount Cuthbert Co. were resumed on Oct. 11, after having been idle since last June. As there have been promising developments recently in the company's mines the smelters are expected to have a successful run. The Mount Elliott Co., another of the three big concerns operating in the Cloncurry district, is still in a state of idleness. The Queensland gold mines—or what are left of them—continue to receive much assistance from the Gold Producers' Association, which distributes amongst its members the proceeds derived from the current premium on the sale of Australian gold. The net premium thus realized during the six months ended June, 1920, amounted to £752,623, and of this sum Queensland received £64,500, which is very acceptable at a time when the gold producer is much in need of help. Twice this year there have been increases in the monthly return of gold now in this state. These have been small, but any improvement at all has been such a rare thing for years past that it is not likely to escape notice. The operations of the once famous and the premier goldfield of the state have now been reduced to those of one company and a few small parties of tributers working on their own account in old mines. One Charters Towers company that has a brilliant past—the Brilliant Extended—has turned its attention to tin mining on the Kangaroo Hills field, north of Townsville. On the Gympie goldfield—which used to rank next to Charters Towers—two more companies "went bung" (as the Australian aboriginal would say of anything that is dead), and the monthly cutput of the field is now under 300 fine oz., as compared with some 6,000 oz. ten years ago.

On the Kangaroo Hills field, which is a tin-mining center, some Charters Towers people have for several months past been developing the Sardine tin mine. In the main shaft of this mine highly "payable" ore has been mined down to 120 ft., and levels taken out from a little lower than this are yielding ore up to 20 per cent of metal. In six months 264 tons of material crushed gave a return of 81 tons of black tin, equal to an extraction of 30¾ per cent—nearly all this ore being obtained from development work. Already the Sardine Tin Mining Co. has paid three dividends of 2s. each per share on 40,000 £1 shares.

Some are apt to look upon Queensland mining as dying because gold mining in the state is at a low ebb, but what is being brought forth in the Sardine tin mine is only another of many proofs which often crop up that in tin, copper, silver, lead, wolfram and molybdenite, the potentialities of the state are still great. At present, however, the mining industry generally, like most other industries, is greatly handicapped by the high cost of materials and high wages, with the added drawback of a scarcity of explosives.

The Palmer, one of the oldest and formerly a very rich goldfield in the extreme north of Queensland, is about to be reopened after lying dormant for many years. Gold was first discovered on this field in 1873, and, as an alluvial area, the extent, amount, and diffusion of its rich deposits transcended anything previously or since discovered in Queensland. Subsequent efforts to work the reefs from which the alluvial is supposed to have been derived failed because the crude methods adopted and the limited means available were quite inadequate to cope with the water difficulty, which proved greater here than in any other field in the state. About £1,000,000 worth of gold has been won from the field, mostly from alluvial workings. In the early days of reefing, picked stone yielded as much as 10 to 15 oz. per ton, but the average from 1877 to 1881 was 2 oz. 5 dwt., the yield over these five years showing a uniformity remarkable if not unprecedented. Some recent attempts to pump out some of the old mines and further prospect the reefs have failed for various reasons. Now, the government has taken the matter in hand and started operations. The plant of a company that did some work with government aid a few years ago has been taken over and a beginning made in dewatering the Louisa, the principal of the old mines. Reefs which gave such consistent yields over a number of years and were abandoned only because the water overwhelmed the crude means of coping with it, ought to be worth a thorough test with up-to-date appliances, especially in view of the falling gold yield of the state. This test, the government states, it is determined to prosecute.

The Canadian Advisory Council for Scientific and Industrial Research has made an appropriation to permit an investigation into the treatment of the silver-lead-zinc ores of British Columbia.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Alaskan Smelter Inadvisable

Government Committee Finds Shortage of Fuel and Ores Precludes Operating Successfully a Local Smelter

A special investigation of Alaskan copper ores made at the request of the Secretary of the Interior, John Barton Payne, was recently completed by Oliver C. Ralston, one of the Bureau of Mines metallurgists. His formal report has just been completed. His conclusions are.

1. Costs of mining and land transportation in Alaska are at present the principal items of expense in the treatment of its copper ores.

2. Under existing conditions, metallurgical treatment of some kind is necessary at localities as near the mines as possible.

3. Conditions are not favorable for a copper smelter in Alaska at present, although with the development of greater supplies of ore it is possible that other adverse conditions could be overcome.

4. Concentration mills or hydrometallurgical plants at the mines are recommended as the logical solution of existing difficulties.

Mr. Ralston's investigation leads him to think that not enough ores are mined and shipped in Alaska at present to support even a small smelter. He found that the type of ores in sight, which are not shipped, is of such character as not to encourage the immediate building of a smelter for their treatment. Conditions generally are such that smelting within the confines of the territory is almost certain to be expensive. He points out, further, that the higher grade fuels have not been developed to the point where a smelter could be assured definitely of a continuous supply of coal. At present, lignite is the only local fuel which can be obtained in sufficient quantities and at a reasonably low cost. He calls attention to the fact, however, that the region is one of excellent prospects and that conditions likely will be different at some future time.

The special examination is an outgrowth of the recommendation to the Secretary of the Interior by the Alaskan Advisory Committee, of which Alfred H. Brooks was chairman. The recommendation was made as a result of pleas put forward by many small mine owners that they could not develop their mines unless they could dispose of their ores to greater advantage. Some mining men in Alaska were of the opinion that a smelter in the territory would be very helpful. Mr. Ralston had not gone far with his investigation when it became evident to him that the chances for a smelter in Alaska are not particularly promising at this time. As a consequence, he looked into the matter of what should be done metallurgically with the copper ores of Alaska as developed at present.

Mr. Ralston reports that the only copper-mining operations which meet with much success in Alaska are those in which the ore is concentrated at the mine before shipment. Some problems in concentration are involved, such as separating chalcopyrite from the heavy pyrrhotite ores or from the massive magnetite ores, but Mr. Ralston gathered the information that flotation treatment of both these types of ores had been tested, with encouraging results. He advises that ores of that type, which do not yield to flotation concentration, should be tested by hydrometallurgical methods.

In discussing the matter of a smelter, Mr. Ralston eliminates the Ketchikan district, as its present production is small and it is within a short distance of a large smelter with relatively low smelting charges. The location which comes nearest to qualifying for a smelter, in Mr. Ralston's opinion, is at tidewater on Prince William Sound. There the question would be whether the ore could be smelted more cheaply at that point than in Tacoma. The freight rate to Tacoma probably does not average much over $4.50 per ton. Moreover, the total ore supply at present is hardly large enough to keep a single reverberatory furnace in operation. That fact alone would make for a high cost. Practically 95 per cent of the ore that is mined is shipped to the Tacoma smelter by the interests that own that plant. Mr. Ralston regards it as probable that this concern would not be interested in building another smelter, even if a slight saving in cost of operation were possible. Owing to the size and facilities of the Tacoma smelter, Mr. Ralston has doubt as to whether a small smelter in Alaska could compete, even with the great differential in its favor.

More War Minerals Awards

Payments aggregating $111,715.18 were recommended by the War Minerals Relief Commission during the week ended Nov. 6. The Southern Manganese Mining Corporation was given an award of $62,898.35, which was 67 per cent of the amount originally claimed. Cummings, Bender, Mahoney, and Corbett were given an award of $2,146.39 in their manganese claim. The amount awarded was 72 per cent of the amount asked. The Clark-Montana Realty Co. was awarded $43,535.60 on its manganese claim, 64 per cent of the amount originally requested. A review of the claim of Webb & Galbraith resulted in an award of $3,050.84, 38 per cent of the amount originally claimed. The claim had been disallowed in June. A. J. Schmidt was allowed an additional $84 on a review of his claim, on which $2,175.42 had been awarded previously.

Income-Tax Deductions for Depletion Allowed Only to Holders at Discovery

Based on an opinion rendered by Acting Attorney General Frierson, the Commissioner of Internal Revenue has rendered an income-tax decision to the effect that the deduction for depletion in the case of mines, oil and gas wells, as the result of discovery on or after March 1, 1913, is allowed only to the party or parties in possession at the time of the discovery, and not to subsequent purchasers.

He also holds that the value which may be set upon the case of the discovery of mines, oil and gas wells, pursuant to the second proviso of Section 234 (a) (9), Revenue Act of 1918, to be depleted in accordance with such reasonable rules and regulations as the Commissioner of Internal Revenue and the Secretary of the Treasury may prescribe according to the peculiar conditions in each case, is, in the case of a lease, to be equitably apportioned between the lessor and the lessee.

Acceptance of W. M. R. Awards Prohibits Later Adjustment

No adjustment of errors in War Minerals Relief claims can be made after the award has been accepted. A decision to that effect has been handed down by the Controller of the Treasury. In the claim of Samuel H. Dolbear, an award of $10,955.15 was made and accepted, full payment having been made Jan. 16, 1920. Later it developed that an item of $2,845.37 should have been included in the award. The Secretary of the Interior issued a settlement certificate in favor of Mr. Dolbear for that amount on June 5, 1920, but the auditor refused to honor the certificate. The matter was carried to the Controller of the Treasury, who held that "if the Secretary of the Interior may reopen settlements made by himself or by his predecessors, it will be necessary to continue the appropriation on the books of the Treasury Department indefinitely." The controller holds that the additional amount due Mr. Dolbear should be passed upon by Congress as a regular claim against the Government.

Purchases of silver under the Pittman Act at the close of business, Nov. 13, totaled 23,075,231 oz.

NEWS BY MINING DISTRICTS

MEXICO

State of Coahuila

Increase in October Shipments From Guadaloupe District

Torreon—Shipments of ore from the San Juan de Guadalupe district to the Torreon smelter increased considerably during October. The San Acasio mine is being operated by T. E. Guzman, and is producing some high-grade silver ore. John Gibson has just shipped in a car of silver-lead ore from the Santa Cecilia mine adjoining it, and Luis Andiffered, a well-known French mining man of Mexico City, is preparing to operate the Recompensa group in the same district.

Dinamita—A practically new mining district is being opened up near the station of Dinamita, about 30 miles west of Torreon. Two groups of mines have been filed on in this vicinity during the last week, one known as the Cornisa and the other the Dinamita group. Some good values in silver, lead, iron, and manganese have been found, and considerable excitement prevails in the camp.

Reyes—Ezequiel Gallegos, representing some German miners, has applied for titles to several groups of mines in the Reyes district, which is becoming quite active. Several shipments of ore were received by the Torreon smelter last week from that camp.

The coal strike in the northern part of this state threatens a coal shortage at the smelters and mines of this district, unless the miners return to work soon. The strike leaders and mine owners are in conference with government officials in Mexico City at the present time.

Jalisco

Canada Mine May Sink Shaft Deeper

The development of the Canada mine is proceeding favorably on the 200-ft. level, and it is now necessary to sink the shaft another 200 ft. to ascertain if the values continue in depth. Broken ore in shrinkage stopes has increased from 52,174.5 tons June 13 to 59,245 tons Sept. 5.

Amparo Mining Co. reports that during the period June 14 to Sept. 5 the mill ran 84 days out of a possible 84 days, treating 34,357 tons, or 409 metric tons per day, with an average gross value of $12.51 per ton, U. S. currency. During this period $58,635.37 was expended for construction, development, and prospecting.

In Globe a suit for foreclosure of a lien and for $400,000 has been filed against the Inspiration-Miami Copper Co. by Joseph Kleinfelder and associates. It is claimed that certain contracts have not been kept.

CANADA

Ontario

Cornish Miners Find Employment at Dome Mines

Porcupine—Labor is now becoming more plentiful, many of the unemployed seeking work in the mines. The Dome mines has increased its force by the arrival of 109 Cornish miners brought out under a four-months contract, which may be renewed.

The McIntyre has developed a large orebody below the 1,000-ft. level. The deposit appears to be a continuation of the Hollinger vein No. 84. Should the Hollinger vein persist to a depth equal to that attained on the McIntyre it will mean a very large addition to the Hollinger ore reserves.

The Little Pet, on which nearly $100,000 had been spent in development, and the Porphyry Hill, both within half a mile of the Dome Mines, have been re-staked.

Ore in sight on the Porcupine Vipond-North Thompson, including that opened up by development down to the 600-ft. level, is estimated at 130,000 tons, valued at over $1,250,000. It is planned to sink to the 900- or 1,000-ft. level, open up main haulage levels, and remodel and extend the present 100-ton mill, increasing its capacity to 150 tons daily.

Kirkland Lake—At the Kirkland Lake, a drift started on the 400-ft. level has been halted on account of labor shortage. The 900-ft. level, the lowest in the camp, is being opened up. The mill is treating 125 tons per day.

A wide vein has been encountered in a crosscut 86 ft. from the shaft at the 300-ft. level of the Bidgood.

Calabogie—The warehouse and packing room of the Black Donald graphite mine, filled with refined graphite ready for shipment, has been destroyed by fire, with a loss of about $30,000, partly covered by insurance.

Cobalt—The Nipissing during October mined ore of an estimated value of $184,578 and shipped bullion and residues from Nipissing and customs ores of an estimated net value of $316,475.

The Bailey mine appeared on the list of shippers for the first time during the week ended Nov. 5, when it sent out a car of 87,116 lb. of ore.

The Kerr Lake crusher alongside its dump of low grade ore is nearly completed. The ore will be treated at the Dominion reduction mill. The veins discovered in digging for the foundation are being tested underground and will be developed on the 90- and 150-ft. levels.

A winze on the Ruby now down 30 ft. has encountered good ore, including some high grade stated to carry 1,000 oz. to the ton. The wall rock shows leaf silver.

The McKinley-Darragh is closing down its Savage property until more labor is available. A fair tonnage of low grade remains to be taken out.

Ontario Kirkland Gold Mines will build a new mill at Tough Oakes.

High-grade ore has been encountered at the Lumsden in a raise from the 225-ft. level. The vein is about 8 in. wide and the ore is stated to carry about 2,000 oz. to the ton.

Gowganda—The Miller Lake Silver Lodes has been taken on option by Montreal interests. A mining plant has been installed and drifting is being undertaken on the 100-ft. level.

West Shining Tree—Hamilton B. Wills & Co., Ltd., on behalf of themselves and other stockholders, have applied for an injunction to prevent the Wasapika Gold Mines, Ltd., from issuing stock to the Wasapika Consolidated Mines, Ltd., in the manner proposed, on the ground that it is not in accordance with precedent, and would tend to deprive innocent purchasers of the stock of their rights.

Elk Lake—The National Mining Corporation, Ltd., of England, with a capital of £2,500,000, has secured an interest in the White Reserve mine in the Maple Mountain district. A comprehensive diamond-drilling program will be carried out under the direction of J. B. Tyrrell, of Toronto.

CALIFORNIA

Old Mines in Calaveras County Reopen—Gasolene-Driven Stamps at Grass Valley Successful

San Andreas—The old Demarest quartz mine, a few miles southeast of San Andreas, may be reopened and further developed. This property was worked several years ago and at that time showed great promise, but, like all true fissure veins on the Mother Lode, the necessity for attaining greater depth became apparent and there was a difficulty in securing the necessary funds for that purpose.

Angels Camp—Work in the Finnegan mine, south of Angels Camp, is going on actively and cross-cutting to tap the eastern vein which has been in progress for several weeks has been completed successfully. The Finnegan adjoins the celebrated Morgan mine and it is claimed to have the north extension thereof.

For the first time in nine years the shrill tones of the whistle at the Rainer gravel mine on Bald Hill, about a mile north of Angels, echoed through the hills. It was the announcement that another one of the long silent gold mines of this locality will resume operations. Water skips are now running and will continue to do so day and night until the underground workings are unwatered. The Rainer mine is

situated on what is generally known as the Valecita channel and which, before reaching the Rainer mine, was fed into by many rich tributary streams. The property is owned by the Rainer Mining Co., Inc. J. Montreeville is general superintendent.

Grass Valley—The test run of the gasoline-driven stamp mill at the Boundary mine was successful. The ore already mined will require two or three weeks to crush and in the meantime the water will be pumped out of the shaft and drifts will be put in order for work resumption. M. J. Brock is manager and principal owner.

The mill at the Alcade mine has been overhauled under the supervision of Lloyd Root. There are now ten stamps at this property and there is a considerable quantity of ore in the bins and on the dumps that will pay to run through the mill.

The labor situation in the Grass Valley district is clearing, although there is a surplus of men seeking places and few experienced miners.

Sacramento—The report of the mineral production of California for 1919 compiled by the state statistician showed that counties that formerly ranked high have in the last year sought lower places. Yuba now ranks first in production, Nevada County second, and Amador third, while Plumas, which was near the tail end for many years, now holds fourth place, due to the development of the copper belt. Sacramento, although considered to be primarily an agricultural county, ranks sixth in mineral production.

The total production of gold, silver and copper has declined from $31,187,807 in 1918 to $22,201,898 in 1919. Gold made a small gain while the production of copper decreased from 47,674,660 lb. in 1918 to 21,732,507 lb. High cost of material did much to keep down mineral production.

San Francisco—No suspension of activity at the property of the Engels company will be caused by the low price of copper, reports E. E. Paxton, president of the company. Mr. Paxton stated that development work upon a greater scale was being planned along with copper production so that when the prices return to normal the mine will be in a position to deliver ore upon a larger scale. Four hundred and fifty miners are employed at the mine.

The Walker mine will lay off most of the force of 170 men and only development work will be carried on during the winter. The reasons given for cessation of production are the low copper prices and high labor, power and transportation costs.

Downieville—Work at the City of Siz quartz property at the head of Slug Canyon ceased for the season on Nov. 1, due to the fact that there are no adequate winter housing facilities. During the summer a raise from the upper tunnel to the surface was completed. In the lower tunnel several crosscuts were run and raises put up, with the result that both foot and hanging wall have been definitely located. Crosscuts driven both east and west at one point in the lower tunnel show the walls at the particular place to be 70 ft. apart.

Sutter Creek—With thirty stamps dropping at the Central Eureka and high-grade ore being found on the 3,900 level conditions at the mine are favorable.

Quincy—The Walker Copper Co. announced on Nov. 2 that high cost of power, high freight rates, and high labor costs, with declining prices for copper, caused it to lay off most of its miners and stop production for the winter. Only sufficient labor will be retained to carry on development and construction work.

Idria — The New Idria Quicksilver Mining Co. announced on Nov. 4 the temporary closing of its large plant as the result of the stagnant metal market. This action leaves but three small quicksilver producers operating in the state. This company's plant has been rebuilt since it burned down in June last.

Colfax—The Crusader mine, a famous property of El Dorado County, now under lease to the Plymouth Consolidated Gold Mining Co., is to developed. The property is owned by Seymour Hill of this county. W. H. Buys is the superintendent in charge.

COLORADO

Durango—The discovery of a new orebody at the Ten Broeck has changed the plans of the company, which will continue operations through the winter. The vein is 5 ft. wide and assays well in gold and silver. It was discovered while drifting in the 3,000-ft. crosscut. If it continues to the surface it will give about 1,600 ft. of stoping ground.

The Esmeralda, on South Fork Lightner, has closed down for the winter. The property was being placed in shape for the erection of a thirty-five-ton mill, when an unexpected heavy snowfall prevented further operations.

The Jumbo Mining Co. has discontinued operations at the Jumbo temporarily, due to a pending deal for the sale of a controlling interest in the mine. The principal silver ore of the Jumbo is in a lime stratum 5 ft. thick.

The Co-operative Mining & Milling Co. has opened a 4-ft. vein of good-grade ore. Work on the road has been discontinued, but it is planned to operate the mine all winter. Lessees on the Idaho have shipped a carload of gold and silver ore to the Durango smelter, which is expected to run about $50 per ton. Lessees on the Mayday are laying track in No. 2 tunnel. Work is progressing at the Cumberland, under the supervision of E. B. Miller. The vein here, in the lower tunnel, is 5 ft. wide and carries about 11 oz. per ton in silver, with a small amount of gold. In the upper workings the vein has an average value of about $60 per ton in gold and silver.

LOOKING DOWN SAN MIGUEL RIVER, COLORADO, FROM FALL CREEK MINE

Cashin — Michigan-Colorado Copper Mining Co. stockholders have asked for a receiver in a petition filed Oct. 29 in Detroit, Mich. Petitioners allege the company to be insolvent, and that they purchased stock as the result of misrepresentations.

Freeland—The Gum Tree property has been leased to W. B. Stewart, who will reopen and develop it.

Telluride—Shipments of concentrates from Telluride during the month of October were as follows: Tomboy, 70 cars; Smuggler-Union, 25 cars; Liberty Bell, 14 cars; total, 109 cars. Shipments have been lower than usual recently owing to the fact that the capacity of the Smuggler-Union has been reduced about 30 per cent since the flotation plant was destroyed by fire.

Pandora—The foundations for the new flotation plant of the Smuggler-Union Mining Co. are being laid and the structural steel is arriving. The new building will be about 200 x 300

ft., and will be fireproof. The new plant will increase the company's treatment capacity to about 700 tons per day. The company is in urgent need of good carpenters, miners, and laborers.

Idaho Springs—Lessee Charles Johnson has opened a pocket of high grade silver ore in the Silver Age property, the ore assaying about 4 per cent lead and over 100 oz. silver.

The Shafter mine, one of the old producers of high-grade gold ore in this district, will be reopened and developed under the direction of Lee Gilson.

Cripple Creek—The new orebody in the property of the Modoc Consolidated Mines Co. has been opened for a distance of 120 ft. and over a width of 25 to 30 ft. The ore is filled with seams of sylvanite, and is averaging about $30 per ton at the mill. About 75 per cent of the material broken and hoisted to the surface is ore. October production was about 2,500 tons, with a gross bullion value of about $75,000. A winze sunk from the 1,300-ft. level indicates the continuity of the ore below this level. Crosscuts are being driven toward the oreshoot from the 1,200-ft. and 1,400-ft. levels. Electric hoisting equipment is being installed at a cost of about $30,000. With this equipment the property's tonnage will be substantially increased. A. H. Frankenberg is general manager.

Breckenridge—The Wellington mines will either curtail operations or close down completely during November on account of an increase in railroad freight rates amounting to $3.50 to $3.75 per ton. The grade of ore produced by the mine cannot stand this increased transportation charge and it is not likely that the company will do more than keep the property unwatered and continue mine development. The Wellington is one of the large producers of zinc ore in Colorado, and the largest employer of labor in Breckenridge.

NEVADA

Tonopah—Bullion shipments for the second half of October are as follows: Tonopah Belmont, $95,700; West End, $62,370; Tonopah Extension, $53,000. Shipments from the Tonopah Mining and the MacNamara companies have not been reported as yet.

No new discoveries or important developments have been made in this district during the past week. Regular development work was performed in the Tonopah Belmont on several veins from the 550, 700, 800, 900, 1,000, and 1,100 levels. Mine tonnage is about 400 tons per day, the balance of the mill tonnage being custom ore. In the Tonopah Extension total development work for the past week was 182 ft., most of which was performed on the 1,540, 1,601 Intermediate, 1,680, and 1,760 levels. Progress in sinking the Victor and McCane shafts was only fair. In the West End development on the West End and Ohio veins was satisfactory. Tonnage for the past week was 1,500 tons. West End operations in Tonopah "76" territory from the Ohio shaft 800 level are progressing satisfactorily in favorable formation. The Tonopah Mining Co. report no changes, regular development being performed in the Mizpah and Silver Top sections of the mine and tonnage to mill was normal. The California Tonopah is making regular shipments which more than pay operating expenses. This company is sinking a winze from the 700 level, which is the lowest shaft level, to the 950. Conditions are reported favorable and the there being no milling plant on the ground.

Blair Junction—The Western Chemicals Inc., owning a potash-alum and sulphur property near Blair Junction, have completed their plant and expect to start operations soon.

Virginia City—One of the biggest ore productions for a single week since the old bonanza days was indicated by the official report of the Consolidated Virginia mine for the week ended Oct. 21. Most of the ore is coming from

MINING CAMPS OF NEVADA

station will be completed and crosscutting begun in about two weeks.

Divide—Although the report of J. H. Farrell on the Tonopah Divide mine showing present reserves of assured and probable ore as 53,158 tons, with a gross value of $21.78 per ton, and a total gross value of $1,158,733, may be disappointing to stockholders, it nevertheless gives them something definite to base their hopes on; at least so far as present available tonnage is concerned. This report checks the one made by E. A. Julian quite closely.

Belle-Helen—There is a revival of interest in this district, located about 50 miles east of Tonopah. The main property has produced about $125,000 gross from a fissure vein in rhyolite, and it is claimed that there is considerable ore of milling grade on the dump and in the mine. All ore produced to date has been shipped to Tonopah or to smelters, the north drift from the winze below the 2,150-ft. level, which is now out 70 ft., having advanced 24 ft. during the week. From this work 67 tons was extracted, which is said to have averaged several hundred dollars per ton.

Pioche—The Virginia Louise Mining Co. will increase its output immediately. Fifty tons of fluxing ore will be sent to the American Smelting & Refining Co., Salt Lake City, which in addition to the contract for 75 tons per day entered into with the U. S. Smelting Co., will materially increase the company's revenue.

Ore shipments from the Pioche district for the week ended Nov. 4 were on a reduced scale, but with assurances of fair future treatment from the officers of the Salt Lake route it is hoped that the shipments will soon be increased. The tonnage amounted to

2,080 tons, distributed as follows: Prince Consolidated, 1,250 tons; Virginia Louise, 510 tons; Bristol Silver, 100 tons; Consolidated Nevada Utah, 175 tons; Ida-May mine, 45.

Ely District.—A contract for the monthly shipment of 200 tons of high-grade manganese ore was recently secured by Joseph Vietti, the ore to be shipped to the Steel Corporation's mills at Pittsburgh, Pa. The Vietti mines are situated near the Coppermines Ranch, in Steptoe valley, and the ore will be hauled by motor trucks to the railroad at East Ely. Mining operations are still being carried on by the Nevada Consolidated Mining Co., but on a greatly reduced scale, only three steam shovels being operated in the big pits.

MICHIGAN

The Copper District

Calumet & Hecla Haulage Level Cemented—Mohawk Company Using Stope Scrapers and Back Filling

The long haulage level which the Calumet & Hecla Mining Co. is driving between the Red Jacket shaft and No. 12 South Hecla shaft has now reached a point 1,000 ft. south of Hecla No. 7 shaft, which leaves about 2,000 ft. of drifting to be done before the south terminal is reached. This haulage level is nine feet high by twelve feet wide and is entirely coated on the sides and back with gunite. This cement coating protects the drift from the damp and smoky atmosphere.

The Arcadian Consolidated Copper Co. is about to cut the seventh level plat in its New Baltic shaft. This leaves 200 ft. of shaft sinking yet to be done before the ninth level is reached from where drifting is to be started toward the old Arcadian shaft. The decision to do this work at the present time has not yet been reached.

The Mohawk Mining Co. in the 25th level of their No. 4 shaft are entering the zone where the Kearsarge amygdaloid lode has proved to be much wider than normal. This phenomenon has been observed on the 22d, 23d, and 24th levels, having a lateral extension of about 400 ft. and is about 40 ft. wide, maintaining good stoping ground for the entire width. In mining the lode for such a width the backfilling method is used. This company is using the recently developed stope scrapers which have proved of much value. The Mohawk Mining Co.'s stamp mill is treating all the ore from the Wolverine mine as well as its own. This arrangement will continue during the present period of decreased production.

Menominee Range

Iron Mountain — Operations have been suspended at the Indiana mine. Work was started there only about two months ago, but the cancellation of several of the ore contracts caused a shutdown.

Crystal Falls—The stockpiles at the McKinney Steel Co.'s mines—the Dunn, Tobin and Odgers—have all been moved and shipments are now being made from the pockets. New equipment will be added at all three of these mines during the winter season, most of it being electrical. The Amasa-Porter and Werner properties will have to carry over considerable ore, as will the Bristol. However, sufficient ore has been shipped to permit stocking room during the winter. The M. A. Hanna Co. has moved all of the ore which was in storage at the Carpenter and Monongahela mines. It is reported that the Judson mine is to pass to the Balkan Mining Co., a subsidiary of Pickands, Mather & Co. The M. A. Hanna Co. is at present operating the mine for the fee owners, but it is stated that the owners desire to place the property outright.

Iron River—Preparations are being made to resume operations at the Fogarty and Baltic mines of the Verona Mining Co. When these mines open up again it is planned to suspend work temporarily at the Caspian in order to permit the shaft being concreted from surface to the ledge. The Fogarty and Baltic have been idle for two years. A complete new electrical equipment has been installed at the Fogarty. The work of concreting the Tully shaft is going ahead steadily. New electrical equipment will be added here. It is planned to reopen the Tully in the spring. Most of the Iron River mines are operating to capacity right now, but several of them will have to carry over considerable ore.

Marquette Range

Diorite—The American-Boston Mining Co. is to close down the American mine at an early date. There is too much water coming in for the pumps to handle and the owners claim that the mine is not making money for the stockholders.

Palmer—The Richmond, Maitland and Empire mines have almost completed shipments and will close down this month. The Isabella is the only property in the Palmer district which will work throughout the winter. There is some talk that the American Steel & Tube Co. will take over this mine from the Cascade Mining Co.

MINNESOTA

Cuyuna Range

Rescue Station Cost Largely Subscribed —Rowe Mine Closed Down

The annual report of August Swanson, Inspector of Mines for Crow Wing County, just published, shows a decrease in fatal mine accidents for the year ending June 30 to six, as against eleven for the preceding year. Sixteen mines were operated. Twenty-eight were inactive, and 1,746 men were employed.

The average daily wage for underground miners during the period was $7.55 for contract work and $5.56 for company account. In the open pits wages varied from $11.56 per day for steam-shovel engineers to $5.17 for common labor; and on surface work from $8 per day for electricians to $4.49 for changehousemen.

A rescue station for the Cuyuna Range is to be built by subscriptions from the mining companies at an estimated cost of $6,000, of which amount $4,500 has been subscribed. The plans call for a building 15 x 30 ft., with two rooms, one for instruction and training in first aid, and the other for storing rescue apparatus, with a man always in charge.

Crosby — Rescue Car 10 of the U. S. Bureau of Mines is scheduled to be stationed on the Cuyuna Range from Nov. 15 to Jan. 8 for purposes of instruction in first aid and mine rescue work. The Portsmouth and the Mahnomen, open pits, have completed shipments for the season.

Riverton—The Rowe mine, operated by Pickands, Mather & Co. for the Pittsburgh Steel Ore Co., has closed down, and the present holders may relinquish their lease on it. Ore blocked out and available to present working levels has been practically exhausted. The operators of the Rowe mine were pioneers in the stripping of overburden from iron mines by the hydraulic method. One and half million yards of overburden was removed at this property at a total cost of 6.7c. per yd.

John A. Savage & Co. plan a screening, crushing, and drying plant at its Sagamore manganiferous iron mine. The drying plant will be two units handling 4,000 tons per day. A portion of the machinery has been contracted for. A Worthington Glendora-type deep-well pump of 100-gal. capacity has been installed at the Sagamore drainage shaft.

IDAHO

Cœur d'Alene District

Tungsten Minerals Discovered in Gold-Bearing Vein

North Fork—High-grade tungsten ore of unusual value has been struck on the property of the Kennon Mining Co. in Pony gulch. The ore was assayed to determine its gold content and it was discovered that 80 per cent of it was tungsten. The tungsten is a vein 8 in. wide in a ledge that is 5 ft. wide; the ledge carries $5 to $6 in gold.

The Ajax mine recently struck a full face of good milling ore in the east drift. The company some time ago sunk a shaft 200 ft. from the Moonlight vein and sunk a winze 120 ft. on the vein. From the bottom of the winze it drifted 150 ft. Most of this distance the tunnel followed a 1-ft. vein of good milling ore. The work was turned to an east drift on the same vein. The ore pinched out but soon came in again better than ever, giving the full face of ore reported. Two shifts are employed.

Wallace — Whatever may be the terms of the settlement between the Hecla Mining Co. and the Federal Min-

ing & Smelting Co., respecting their rights to the apex of the Hecla "east vein," they can have no bearing on the ownership of the main vein of the Hecla. This great orebody is now being explored at a depth of 2,000 ft. from the collar of the shaft and approximately 3,500 ft. from the surface. The drift has been advanced six or seven hundred feet in the ore, showing five feet of solid shipping lead-silver ore without a trace of zinc and an equal amount of good milling ore. This is pronounced the best showing that has been exposed in the mine. On the 1,600 level this oreshoot was 1,800 ft. long and averaged 6 to 10 ft. wide. The opening of 2,000 level adds 400 ft. of vertical depth on the ore.

Mullan — The Federal Mining & Smelting Co. has awarded a contract to sink the main shaft of the Morning mine 200 ft. deeper, making its total depth 1,450 ft. below the main working tunnel. There has been a pronounced improvement in the grade of ore with each succeeding level, and the amount of lead as compared with zinc has steadily increased. The orebody continues very large.

ILLINOIS

Elizabethtown—On Saturday, Nov. 6, the magazine on the 300 ft. level of Fairview Fluorspar & Lead Co.'s mine was found burning. Several hundred pounds of dynamite was stored in this magazine. Rescue men put on gas masks and went into the mine, bringing all overcome by the smoke and fumes to the surface. One man was taken to the hospital, others will recover within a few days. This is one of the mines at which the strike is still on. Several of the striking miners have been taken back and put to work, they turning in their union cards at the office before going to work. It is not known how the magazine caught fire, it being in a damp, cool place, and being, also, a stone-wall room. There was no explosion. The mine is running full force regardless of the union strikers.

MONTANA

Butte—Davis-Daly Copper Co. drifting operations on the 2,700-ft. level of the Colorado mine continue. The improved showing on this level is suggesting sinking the Colorado shaft an additional 200 ft.

Plans for the active participation of the Anaconda Copper Mining Co. in the fertilizer industry are going forward steadily. Experiments at the Washoe works in the manufacture of fertilizer are proving instructive for its economical production. Anaconda continues to do a fair amount of silver ore development together with its repair work and general copper ore development.

President C. F. Kelley of the Anaconda company has publicly denounced as untrue the statement circulated by labor agitators to the effect that the company intends to bring about a reduction of wages.

Tuolumne Copper Co. shipments from the Main Range mine continue about 100 tons per day. Development work is chiefly drifting on the 1,200-ft. level.

Development work has been cut down at the Black Rock mine of Butte & Superior, and the principal work underground aside from production is the raising out from the 2,300-ft. level to connect with the No. 3, the main shaft.

Development work by the North Butte is being slowed down. The Edith May vein on the 3,600-ft. level is being driven for as fast as it is possible, heat conditions interfering somewhat.

Elkhorn—Boston & Montana expects to cut the Park vein on the 300-ft. level within the next two weeks. Drifting on the Blue Jay is said to be showing further milling ore. Union Pacific system is negotiating for the Montana-Southern Railway, the ore-carrying line of the Boston & Montana.

Grass Valley—Stemwinder Mining Co. plans a boarding house, a bunkhouse and a leaching plant at its property near Helena. An assay office already has been installed. Ore runs high in silver, and two shafts have been sunk, one to 110 ft. and the other to 85 ft.

Marysville—The Philadelphia Mining Co. has resumed operations at the Bell Boy property, with lead-silver ore uncovered in the Nile claim. Drifting is under way.

Neihart—Reports again are in circulation that the Silver Dike company plans a 500-ton concentrator to treat the Silver Dike ores, and that the plant will be either on Carpenter or Belt Creek.

Saltese—An intrusive dike has been entered by the Long Montana-Idaho tunnel being driven to reach a point under what is known as the Monitor orebody, and the indications are regarded as good for an ore showing. The Wilson Mining Co. will resume operations on a group of fourteen claims, through which strike two strong parallel veins with evidence of a silver-lead content.

Philipsburg—The owners of manganese properties are developing silver properties. At the Sweet Home there was recently opened a body of ore which has assayed 900 oz. to the ton.

JOPLIN-MIAMI DISTRICT

Oklahoma—Kansas—Missouri

Aurora, Mo.—Fire of unknown origin destroyed the concentrator of the Red Wasp Mining Co., two miles north of here, on Nov. 11. The mill had been idle for some months, but was recently purchased by Larry Brunk, who intended to start it up in the spring. He had contracted for prospect drilling on the lease, which formerly was a good producer. He carried $5,300 insurance on the mill, and had recently refused an offer of $16,000 for it. It was built in 1916 and was fully equipped with modern machinery with the exception of the electric motors, which were removed some time ago.

Flat River—The machine shop of the Federal Lead Co. at their No. 1 shaft was destroyed by fire recently. In it was one of their latest improved underground power shovels. While the accident will temporarily cripple them, their other machine shops, the Nos. 3 and 4 mills will enable most of the work to be carried on as usual.

UTAH

Salt Lake City—Increased freight rates coupled with the lowered price of zinc, mark the retirement, for the time being at least, from the Utah field of the Grasselli Chemical Co., for the past twenty years continuously represented by buyers in Utah. The company will devote its energies to the Joplin district. In general, much anxiety is felt here regarding the increase in freight rates, especially within the state, as allowed by the Interstate Commerce Commission and opposed by the Utah Public Utilities Commission. The output of Utah mines will be further cut if the proposed increases are allowed to stand. H. W. Prickett, Walter Fitch, president of the Chief Consolidated Mining Co.; Jackson McChrystal of the Gemini, Ridge & Valley, and Godiva mines, representatives of the Grand Central Mining Co., of Tintic, and A. G. MacKenzie all exhibited statistics and letters demonstrating great present profits by the railroads and the already disastrous effects to mines and smelters as a direct result of the increase in freight rates of June 25, 1918. Mr. MacKenzie pointed out what might be expected if the proposed increases asked were allowed to stand. The hearing on in Salt Lake City before Examiner Disque was concluded Nov. 5, and Dec. 10 has been set as the date for the filing of briefs, after which the case will be referred to the commission at Washington, with such findings and recommendations as the examiner may see fit to make.

Bingham—The directors of the Bingham Mines company—owning the Dalton & Lark and Yosemite mines at Bingham and Victoria at Tintic, and controlling the Eagle & Blue Bell, at Tintic—propose with the consent of the stockholders, to purchase 50,000 shares at $10 per share, to be held as treasury stock.

Eureka—The Tintic Standard during October shipped 150 cars of an average tonnage of 55 tons, the ore coming from three different stopes. More ore could have been shipped with more railroad cars available.

Park City — Park City shipments amounted to 1,843 tons, as compared with 1,634 tons the week preceding. The Silver King Coalition plans a company store providing supplies to its employees at cost. Labor conditions at the camp are improving, and the company has opened a new ore zone of promise. The Judge Mining & Smelting Co. will add coal to its store's commodities expecting this to reduce the price of fuel to its employees by about $4 a ton.

THE MARKET REPORT

Daily Prices of Metals

Nov.	Copper N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
11	14.50@14.60	36.25	37.00@37.50	6.50@6.60	6.50@6.60	6.45
12	14.45@14.60	36.00	37.00@37.25	6.50	6.50	6.35
13	14.45@14.60	36.00	36.75@37.25	6.50	6.50	6.35
15	14.40@14.60	35.00	36.00@36.25	6.25@6.50	6.25@6.50	6.30
16	14.35@14.60	35.50	36.50@37.00	6.25	6.25	6.20
17	14.35@14.60	36.75	37.25@37.75	6.00@6.35	6.00@6.35	6.15@6.20

*These prices correspond to the following quotations for copper, "delivered": 14.65 @14.75, 14.60@14.75, 14.60@14.75, 14.55@14.75, 14.50@14.75, and 14.50@14.65c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

Nov.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
11	87⅞	87	99	244	249	34	33⅞	36	37¼
12	87¼	86¾	99	244¾	249¾	34½	33½	36	37⅜
13	....	....	...	...	...	...	...	...	...
15	85¾	84½	96	236½	242½	34⅜	32½	34¾	36¼
16	84¾	83¾	95½	239	242½	33½	31⅛	34	36⅛
17	84	83¾	95	242¾	246	32	31⅜	35	36⅜

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Nov.	Sterling Exchange	Silver			Nov	Sterling Exchange	Silver		
		New York, Domestic Origin	New York, Foreign Origin	London			New York, Domestic Origin	New York, Foreign Origin	London
11	336½	99½	80⅞	54⅛	15	336	99½	76½	51⅜
12	336	99½	80⅜	53⅞	16	339	99½	76⅝	51
13	336	99½	79⅜	53⅛	17	345	99½	78¾	51⅜

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

Metal Markets

New York, Nov. 17, 1920

The downward trend of metal prices has continued during the last week. Many producers are unwilling to sell at current levels, and the market is made by those interests willing to cut prices to make sales. Demand is very weak, and only small lots are being sold. Manufacturers are unwilling to carry large stocks on their year-end inventories, and there is little hope of improvement before the holidays.

Copper

Most of the large producers are willing to sell copper for any delivery at 14.75c. delivered, but buying is of small volume. Some sellers are glad to get rid of spot metal at 14.50c. delivered. What little export demand existed has fallen away to a large extent with the recent decline in exchange rates.

Wages and salaries have been reduced 15 per cent and production has been curtailed by the Calumet & Hecla company. The movement is likely to spread to other producers, with copper at present prices, and further programs of curtailment are being definitely planned.

Lead

Monday afternoon, Nov. 15, the A. S. & R. reduced the price of lead from 7c. to 6.50c. for both New York and St. Louis delivery. This was in line with the general price movement here, and no doubt was also influenced by the continued fall in London. The A. S. & R. official price in St. Louis, it will be noted, remains on a parity with that in New York.

The price of lead in London was expected to fall, as it was considered too high, but it is rumored that the decline was hastened by American selling of futures in that market. The London price might be steadied by a combination of the Australian and Spanish producers, but then there would be the possibility of Mexican lead going to London. Production in Mexico has been much curtailed recently on acount of the strike of the coal miners, but this is expected to be settled in a few days; mining will then be resumed.

Chemical lead continues to command a premium, particularly for delivery this year, and can hardly be obtained under 7c. in either St. Louis or New York for November metal.

Dealers are showing an interest in lead at current prices, and the speculative element may soon come into the market.

Zinc

The gradual decline continues. To make predictions in these times is hazardous, but it is considered likely that this metal is near the bottom. Metal for forward delivery commands a premium of about 10 points.

The price of zinc is so far below the cost of production that output is being markedly reduced. Several weeks ago most of the mines in the Joplin district closed down for two weeks, and operations are still much curtailed. The Butte & Superior Co., which had been producing about 7,500,000 lb. of zinc a month, has entirely suspended, Anaconda is reported to have cut production from 10,000,000 to 5,000,000 lb. per month, and the Interstate-Callahan company is closed down. As this country probably now produces close to three-quarters of the world's zinc, the domestic curtailment should have a marked effect in steadying the market.

Tin

Traders continue anxious to buy for forward delivery, but there is no large consumer demand, and the market is quiet. The stocks of tin are now fairly well liquidated and in stronger hands, and the feeling is that the price is likely to rise. Whether temporary or not, there was a pronounced strengthening today, inspired by an advance in London and the higher rates of sterling for the last two or three days.

A few sales of electrolytic have been made, but the market is very quiet at approximately the same prices as for Straits.

Straits tin for future delivery: Nov. 11th, 38.50@39c.; 12th, 38.25@38.50c.; 13th, 37.75@38.25c.; 15th, 36.75@37.25c.; 16th, 37.50@38c.; 17th, 38.50@39c.

Arrivals of tin in long tons: Nov. 9th, Australia, 50; 10th, Straits, 40; China, 15; 13th, Straits, 125; China, 25.

Silver

Since our last report, the London price has fallen daily until the 17th, when it reacted to 51⅜d. The New York quotation also dropped in sympathy with London until the 16th, when the improvement in sterling exchange brought about an advance in the New York market, despite the lower price in London. Sterling exchange advanced again sharply on the 17th, and these violent fluctuations have a marked effect on silver prices. The fall in silver is due to the weakness of the Eastern exchanges and the dullness of the export trade.

Mexican Dollars — Nov. 11th, 61⅝; 12th, 61¼; 13th, 60½; 15th, 58½; 16th, 58½; 17th, 60⅛.

Gold

Gold in London: Nov. 11th, 121s. 4d.; 12th, 121s. 11d.; 15th, 121s. 6d.; 16th, 120s. 9d.; 17th, 118s. 9d.

General Stock of Money in the United States Nov. 1: Gold coin (including bullion in Treasury), $2,739,043,566; gold certificates, none; standard silver dollars, $269,857,494; silver certificates, none; subsidiary silver, $264,697,830; Treasury notes of 1890, none; United States notes, $346,681,016; Federal Reserve notes, $3,663,517,685; Federal Reserve banknotes, $238,601,900; National banknotes, $732,549,629; total, $8,254,949,120.

Foreign Exchange

A weak tendency in European exchanges generally, continued through last week, but for the last three days a rebound has been in evidence, though how long it will persist is problematical. On Tuesday, Nov. 16, francs were 5.91c.; lire, 3.56c.; and marks, 1.39c. New York funds in Montreal, 12¼ per cent premium.

Other Metals

Aluminum—For 50-ton lots: ingot, 99 per cent and purer, 33.1c.; 98@99 per cent, 32.90c. Outside sales reported at 31c. for both grades.

Antimony — Chinese and Japanese brands, 6¼@6¾c., market very quiet; W. C. C. brand, 8¼@8¾c. per lb. Cookson's "C" grade, 12½@13c. Chinese needle antimony, lump, nominal at 5¾@6¼c. per lb. Standard powdered needle antimony[1] (200 mesh), 9c. per lb. Market dull.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 10c.

Bismuth—$2.55 per lb., 500-lb. lots, and $2.57 per lb., 100-lb. lots.

Cadmium—Nominal, $1.40@$1.50 per lb. Market steady.

Cobalt—Metal, $6 per lb.; black oxide, $4.00 per lb.; sulphate, $1.60.

Iridium—Nominal, $350@$400 per oz.

Magnesium—Crude, 99 per cent or over pure, $1.75 per lb. for 100 lb. lots and over, f.o.b. Niagara Falls.

[1]**Molybdenum Metal** in rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Ingot, 43c.; shot, 43c.; electrolytic, 45c., f.o.b. Bayonne, N. J.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—Open market, $70@$80 per troy oz.

Palladium—$85 per oz. Dull.

Platinum—Firm at $85@$90 per oz.

Quicksilver—Market quiet; $58@$60 per 75-lb. flask. San Francisco wires $55@$62. Easy.

[1]**Rhodium**—$200@$225 per troy oz.

Ruthenium—$175@$200 per troy oz.

[1]**Selenium**—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $20 per lb.

[1]**Tungsten Metal**—$35@$60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Guaranteed 50 per cent Cr_2O_3 foreign ore with a maximum of 6 per cent silica, 65@70c. per unit, New York. California concentrates, 50 per cent Cr_2O_3 and upward, 70@75c.

[1]**Manganese Ore**—50c. per unit, seaport; chemical ore (MnO_2) $60@$70 per gross ton, lump; $80@$90 per net ton, powdered.

Molybdenum Ore—85 per cent MoS_2, 65@70c. per lb. of contained sulphide, New York.

[1]**Tantalum Ore**—Guaranteed minimum 60 per cent tantalic acid, 55@65c. per lb. in ton lots.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, 1¼@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 15c. per lb. for ore, with concessions on large lots or running contracts.

Tungsten Ore—Scheelite, 60 per cent WO_3 and over, per unit of WO_3, $6 f.o.b. mines; wolframite, 60 per cent WO_3 and over, per unit of WO_3, $4.25@$4.50, in New York.

Uranium Ore (Carnotite)—$2.75@$3 per lb. for 96 per cent of the contained oxide (U_3O_8). Ores must contain a minimum of 2 per cent U_3O_8.

Vanadium Ore—$2 per lb. of V_2O_5 (guaranteed minimum of 11 per cent V_2O_5), New York.

[1]**Zircon**—Washed, iron free, 5c. per lb.

[1]**Zirkite**—According to conditions, $80@$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., Nov. 13—Zinc blende, per ton, high, $47.45; basis 60 per cent zinc, premium, $39; Prime Western, settling, $45@$37.50, buying, $37.50; fine sand slimes, $35@$32.50; calamine, basis 40 per cent zinc, $35. Average settling prices. Blende, $45.16; calamine, $38.96; all zinc ores, $45.05.

Lead, high, $103; basis 80 per cent lead, settling, $110@$65; buying, $65; average settling price, all grades of lead, $83.83 per ton.

Shipments for the week: Blende, 10,698; calamine, 194; lead, 1,680 tons. Value, all ores the week, $627,380.

Seventeen mines are reported as not having resumed following the voluntary cessation of operations by 85 per cent of the producing mines. These are reported as closed indefinitely. It is estimated the mines in operation will produce 7,500 to 8,000 tons per week. Stock in bins is estimated at 45,000 tons, 30,000 unsold, 15,000 sold, and 2,800 tons sold ahead of production. One company is holding 16,000 tons of the unsold ore, the balance being widely distributed.

Reports have been received here that smelters at Van Buren, Blackwell, and Bartlesville had closed down or would be closed soon.

Platteville, Wis., Nov. 13—Blende, basis 60 per cent zinc, $43.50 per ton for high grade. Lead ore, no sales. Shipments for the week: Blende, 596; calamine, 30 tons. Shipments for the year: Blende, 58,521; calamine, 2,534; lead, 4,428; sulphur ore, 1,342 tons. Shipped during the week to separating plants, 2,014 tons blende.

Non-Metallic Minerals

Asbestos—Crude, No. 1, $2,000@$3,000; No. 2, $1,400@$1,700; spinning fibres, $400@$800; magnesia and compressed sheet fibres, $325@$500; shingle stock, $110@$150; paper stock, $60@$75; cement stock, $17.50@$30; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to be added as Canadian royalty export sales tax.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, carload lots; (off-color) $22@$26 in bags, carload lots; all f.o.b. Kings Creek, S. C. Crude, 88 to 94 per cent, $23; ground (white), $45; ground (off color) $30@$32 per net ton, less than carload lots, f.o.b. New York. Crude, first grade, $10 per ton, f.o.b. cars, Missouri; floated, $28 per ton in bbls.; $26.50 per ton in 100-lb. bags; extra charge for bags, f.o.b. St. Louis.

Chalk—English, extra light, 5@7c.; light, 5@6c.; dense, 4½@5c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $9@$12; washed, $12@$15; powdered, $18@$22; bags extra, per net ton, f.o.b. mines, Georgia; crude, $8@$12; ground, $15@$40, f.o.b. Virginia points. Domestic lump, $10@$20; powdered, $25@$30; imported lump, $25@$35; powdered, $30@$35, f.o.b. New York.

Feldspar—Crude, $8@$14 per gross ton, f.o.b. Maryland and North Carolina points; $7.50@$10, f.o.b. Maine; ground, $27@$30, car lots, f.o.b. Baltimore; ground, $17@$21, f.o.b. North Carolina points; $17@$21 per ton, No. 1 ground, f.o.b. New York State; $21@$23 per ton, ground, f.o.b. Maine. Crude spar very scarce.

Fluorspar — Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $25 per ton, f.o.b. Illinois mines, and $27.50, f.o.b. Kentucky; ground, suitable for acid, chem-

[1]Furnished by Foote Mineral Co., Philadelphia, Pa.

ical or enameling purposes, $60; lump, $17.50, f.o.b. Tonuco, N. M. In Canada 85 per cent calcium fluoride sells for $20 per ton f.o.b. Madoc; output limited. Canadian price generally $18 (Canadian currency) per ton, f.o.b. mines; market inactive.

Fuller's Earth—$18 per ton carload lots, f.o.b. New York.

Graphite—The 90 per cent crucible grade is held in Alabama for 9c. per lb. and 85 per cent grade is practically unobtainable, prices being 7@9c. The higher lubricating grades sell for 11@40c., according to carbon content.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Dolomite, 1@2 man size, $1.60@$1.65; 2@8 in., $1.55@$1.65 per net ton, f.o.b. Plymouth Meeting, Pa.; fluxing, $1.65@$1.75 per net ton, f.o.b. Howellville, Pa.

Magnesite, Calcined — High-grade caustic calcined, lump form, $35@$40 per ton, carload lots, f.o.b. California points. In Chicago district, $57.70; Atlantic seaboard, $61@$63.

Dead-Burned—$36.50 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $55@$60 per ton, f.o.b. Baltimore. (Magnesite brick—See Refractories.)

Mica—India block mica slightly stained, per lb.: No. 6, 50c.; No. 5, $1.20@$1.40; No. 4, $2@$3; No. 3, $4.25@$5; No. 2, $5.50@$7; No. 1, $8. Clear block: No. 6, 55c.; No. 5, $2; No. 4, $3.50; No. 3, $5, No. 2, $6.50; No. 1, $8; A1, $10; extra large, $25, all f.o.b. New York; ground, $150 per ton, Philadelphia. Domestic, uncut, f.o.b. Franklin, N. C., as follows: Scrap, $45@$50 per ton; punch, 10c. per lb.; circle, 15@25c.; 1½ x 2 in., 75c.; 2 x 2 in., $1.15; 2 x 3 in., $1.65; 3 x 3 in., $2.10; 3 x 4 in., $2.50; 3 x 5 in., $2.75; 3 x 6 in., $3.75; ground 165 mesh, $240 per ton; ground roofing mica, $60; mica washers, 75c.@$2 per lb.; 1¼-in. disks, No. 1, $1.60 per lb.; No. 2, $1.30. The foregoing domestic prices obtain also in the Chicago district.

[1]**Monazite** — Minimum of 6 per cent thorium oxide, $35 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $13; 75 per cent, $11.50; 75@74 per cent, $11; 70 per cent, $8.35; 68 per cent, $7.85; 68@66 per cent, $7.60. Finely ground Tennessee rock sells for $8.50 per net ton for 13 per cent phosphorus content, agricultural application; for acid-making, 14 per cent, $9; both prices f.o.b. Centerville, Tenn.

Pumice Stone—Imported, lump, 4@50c. per lb.; domestic lump, 6c.; ground, 4@7c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 12c., c.i.f. Atlantic seaport; furnace size, 17c.; Spanish lump, 14@16c.; domestic fines, f.o.b. mines, Georgia, 12@14c.

Quartz—(Acid tower) fist to head, $10; 1½ to 2 in., $14; rice, $17, all net ton, f.o.b. Baltimore; lump, carload lots, $5@$7.50 net ton, f.o.b. North Carolina mines.

Sand (Glass)—Dry glass sand, $4 per net ton, f.o.b. cars Mapleton, Pa. Sand, f.o.b. Ottawa, Ill., is $3 per ton; $2.50 on annual contracts. Sand at Klondike, Gray Summit and Pacific, all in Missouri, is $2.50 on contract; some outside sales have been made at $4. St. Louis, open market, at $3.50; contract price on large quantities, $2.50; on small quantities, $3.

Sulphur—$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines. Market quiet.

Talc — Paper making, $12@$22 per ton; roofing grades, $9.50@$15; rubber grades, $12@$18, all f.o.b. Vermont. California talc, $20@$45, talcum powder grade. Southern talc, powdered, carload lots, $12@$15 per ton; less than carload, $25, f.o.b. cars; freight to New York $5.25 per ton, carload lots; less than carload lots, $9.25. Imported, $60@$70; Canadian, $20@$40 per ton.

Mineral Products

Arsenic—White arsenic, 14@14½c. per lb.; sulphide, powdered, 18@19c. per lb. in carload lots.

Sodium Nitrate—$3 per cwt., ex vessel, Atlantic ports. Market quiet.

Sodium Sulphate—For 95 per cent material, $22 per ton, f.o.b. mines, Idaho and Arizona, spot and six months' contract.

Potassium Sulphate—Domestic, $225@$250 per net ton, basis 90 per cent, f.o.b. New York.

Ferro Alloys

Ferrocarbontitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 18@19c. per lb. of chromium contained; 4 to 6 per cent carbon, 17@18c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $175, freight allowed; $170, f.o.b. seaboard bases; English, $165@$170, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $70, f.o.b. furnace.

[1]**Ferromolybdenum**—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2.25@$2.50 per lb. of contained metal, f.o.b. works.

Ferrosilicon—For 10 to 15 per cent. per gross ton, f.o.b. works, $60@$65: 50 per cent, $80@$85; 75 per cent, $160.

[1]**Ferrotungsten**—Domestic, 70 to 80 per cent W, 75@90c. per lb. of contained tungsten, f.o.b. works. Foreign, 70c.

Ferro-uranium—35 to 50 per cent U. $7 per lb. of U contained, f.o.b. works.

[1]**Ferrovanadium**—Basis 30 to 40 per cent, $6.50@$7.50 per lb. of V contained, according to silicon content, f.o.b. works.

Metal Products

Copper Sheets — Current New York price, 24½c. per lb.; wire, 19c.

[1]Furnished by Foote Mineral Co., Philadelphia, Pa.

Lead Sheets—Full lead sheets, 10½c.; cut lead sheets, 10¾c. in quantity, mill lots.

Nickel Silver — Unchanged at 35¾c. per lb. for 18 per cent nickel.

Yellow Metal — Dimension sheets, 22¼c.; sheathing, 22¼c.; rods, ⅝ to 3 in., 19¼c.

Zinc Sheets—$11.50 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter; zinc plates, 10½c. per lb.

Refractories

Bauxite Brick—56 per cent alumina, $160 per 1,000, f.o.b. Pittsburgh.

Chrome Cement—40@45 per cent Cr_2O_3, $55@$60 per net ton, and $65 in sacks, carload lots, f.o.b. eastern shipping points.

Fire Brick—First quality, 9-in. shapes, $55@$60 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $45@$50.

Magnesite Brick — 9-in. straights, $110 per net ton; 9-in. arches, wedges and keys, $120; soaps and splits, $130.

Silica Brick—9-in., per 1,000: Chicago district, $65@$70; Birmingham, Ala., $56@$61; Mount Union, Pa., $55@$60.

Iron Trade Review

Pittsburgh, Nov. 16, 1920

Demand for steel products in the open market continues extremely light, with not enough inquiry, running into tonnage, to develop the lower prices some of the independent producers would probably be glad to quote for the purpose of securing more business. Demand against contracts has decreased little in the last week, the period of cancellations and postponements being nearly ended.

Predictions that the iron and steel industry will witness a buying movement next April or thereabouts, with a stiffening in prices following the decline now in progress, are made with less confidence than recently, it being observed that the readjustment promised for other industries must be extensive and require time for consummation. Occasionally, predictions are made that the decline in steel prices will not stop with a decrease in independent prices to the level now maintained by the Steel Corporation.

Pig Iron—Foundry iron has been offered by furnaces at $40, Valley, or $1 decline from last week's quotation. Bessemer remains at $42 and basic at $38.50, Valley, both being quite inactive. Freight to Pittsburgh is $1.96. Two additional merchant furnaces in the valleys are blowing out.

Semi-Finished Steel—The market remains stagnant, with no inquiry to test values. Sheet bars could probably be obtained without difficulty at $60, against the nominal quotation of $65 last week, and billets remain quotable at $55 and rods at $70.

Charcoal and Coke

Charcoal—Willow, 7c. per lb. in bbls. hardwood, 6c. per lb., in 250-lb. bbls.

Connellsville — Furnace, $10@$12; foundry, $8@$10.

The Position of Silver

Domestic Producer Favored by a Fixed Price—Exports Going Mainly to China and Not to India—Asiatic Conditions None Too Bright—India Now on a New Rupee Rate

THE Treasury, under authority of the Pittman Act, has purchased over 23,000,000 oz. of domestic silver at $1 per oz. since the repurchases were first authorized—May 13, 1920. At this rate of buying it will take about four and one-half years to complete the purchase of the entire 207,000,000 oz. In the meantime the American silver producer is placed in a favorable position, for whereas the general economic tendency in commodity prices is downward, the silver producer will realize a fixed price for his product for some time to come.

The average price of foreign silver since its drop below $1 and up to Nov. 15 amounts to about 90c. It would thus seem that the American silver producer on his sale of 23,000,000 oz. of silver to the Government has realized about 10c. above the market, equivalent to about $2,300,000 above the outside market prices. As the price of mining supplies drops, the cost of silver mining should decrease. This is an important consideration for the silver miner, as, even with the price of silver at $1, frequent complaint is heard about the high cost of production.

The average monthly price of foreign silver has declined in steps since the first of the year, and, judging from the declines that occurred in other commodities, the reputation of silver as an economic barometer is strikingly sustained. The drop in silver took place several months before the general commodity price decline, but was greatly retarded by the stabilizing effect of the Pittman Act, with its resultant withdrawal of American silver from the market.

1920 AVERAGE PRICES OF FOREIGN SILVER AT NEW YORK

In Cents per Troy Ounce, 999 Fine

Jan.	132.827	June	90.957
Feb.	131.295	July	91.971
Mar.	125.551	Aug.	96.168
Apr.	119.779	Sept.	93.675
May	102.585	Oct.	83.486

During the first nine months of this year there was imported into the United States almost $73,500,000 in silver, and at the same time about $98,700,000 in silver was exported, as compared with imports amounting to $64,000,000 and exports of $177,100,000 for a similar period in 1919, which is a decided drop in exports. It is of interest to observe from the following table the different destinations of the exported sillver in 1920 as compared with that sent abroad in 1919. During the first nine months of last year India received the greatest amount of silver from the United States, $109,000,000, and China, including Hongkong, less than one-third as much as India, $34,000,000. In 1920, over a similar period, China, and Hongkong, took about $76,000,000 in silver, whereas India imported only $223,000 from the United States. This fact forcibly illustrates the great influence Chinese buying has had lately in sustaining the market. At present Chinese support is about all that is preventing a further sharp decline.

MOVEMENTS OF SILVER TO AND FROM THE UNITED STATES, NINE MONTHS ENDING SEPTEMBER, 1920 AND 1919

EXPORTS

To	1920	1919
China	$55,977,000	$29,528,000
Hongkong	20,015,000	4,784,000
Canada	6,119,000	2,808,000
England	4,520,000	13,055,000
India	223,000	108,877,000
Mexico	2,840,000	988,000
France	33,000	6,588,000
Others	8,955,000	10,476,000
Totals	$98,682,000	$177,104,000

IMPORTS

From	1920	1919
Mexico	$44,795,000	$ 45,173,000
Peru	9,786,000	6,610,000
Central American States	6,023,000	2,683,000
Canada	3,068,000	5,560,000
Chile	2,607,000	1,459,000
D. E. Indies	2,290,000	971,000
Others	4,893,000	1,530,000
Totals	$73,462,000	$63,986,000

Asiatic conditions are none too rosy. The report of an impending famine in China will not be conducive to trade movements. As Samuel Montagu & Co. aptly point out, "China unfortunately is not in the position of India, where, should drought and distress prevail, the government is able to organize relief on a large scale and possesses the financial resources necessary for methods involving considerable expenditures." China's export trade is almost at a standstill, and exporters are having exchange difficulties concurrent with the decline in silver. The large silver imports of China are ascribed not only to a replacement of the silver shipments made during the war to India but to the ill repute into which paper money has fallen in the interior of Asia, where Russian currency normally figured. Samuel Montagu & Co. estimate that 50,000,000 to 60,000,000 oz. of silver may be absorbed annually by China for use in the interior of Asia.

India has changed the value of the rupee from Rs. 15 to the £1 to a rate of Rs. 10 to the £1. This step was considered earlier in the year, being the result of the recommendations of the India Exchange and Currency Commission appointed to study the reorganization of India's currency. The great rise in silver last winter forced the face value of the rupee above its bullion value and made the coinage of rupees highly unprofitable to the government. At the time the commission's report was made, silver commanded a high price, over $1.30 per oz., and the step to reorganize the currency was taken not only to bring back the token character of the coin but to prevent as far as possible a recurrence of conditions under which the intrinsic value of the rupee exceeded its face value. Two alternatives were open—to reduce the fineness of the coin or to reduce the rupee rate, that is the number of rupees which could be exchanged for a given weight of gold—the sovereign. The commission recommended the latter course, and the reorganization was put into effect, after proper notice had been given, on Oct. 1. In so doing India took a remarkable step in monetary finance and one which has provoked both favorable and unfavorable comment. The following table compares the old and new rates:

	Old Rate Rs. 15 to £1	New Rate Rs. 10 to £1
Par value of rupee in English currency	1s. 4d.	2s.
Par value of rupee in U. S. currency	32.44c.	48.66c.
Face value rupee @ 80c. silver	27.50	27.50
Face value rupee @ 100c. silver	34.37	34.37

Besides the Asiatic consumption of silver, there has been introduced another consuming quarter. Mexico is reported to be continuing to purchase silver for coinage purposes, but in relatively small amounts, at an average price 4¾c. above the New York foreign quotation for silver, and used about 1,450,000 oz. in July for the purpose. As the power of Mexico to absorb silver is controlled largely by the number and wealth of the population, it is interesting to note that the amount of money in circulation in Mexico, according to S. R. Wagel, is 28,655,000 pesos, or at the rate of 1.91 pesos—95½c.—per capita. In the United States the money circulation on Nov. 1 amounted to $6,393,140,000, or $59.48, on a per-capita basis. Mexico is on a sound metallic basis, with little paper money, whereas the United States has in circulation large amounts of paper.

Although Mexico is coining silver and the United States is operating its mints to capacity in the coinage of subsidiary silver, it is not very encouraging to note the tendency in many countries to get away from the use of silver coins. Germany is reputed to be using everything from porcelain to zinc. Aluminum and iron coins are stated to be common there. Other nations whose currency has greatly depreciated cannot of course keep silver in circulation. Bad money drives out good money, and so some other expedient has to be instituted. Hence Germany's abandonment of silver.

MINING STOCKS

Week Ended November 13, 1920

Stock	Exch.	High	Low	Last	Last Div.	
COPPER						
Adventure	Boston	*70	*60	*70		
Ahmeek	Boston	57	52	52	Sept. '20, Q	.50
Alaska-B.C.	N. Y. Curb	⅞	⅝	¾		
Allouez	Boston	23	20	20	Mar. '19,	1.00
Anaconda	N. Y.	50⅜	45¼	45⅛	Aug. '20, Q	1.00
Ariz. Com'l	Boston	8⅛	8	8⅛	Oct. '18,	.50
Big Ledge	N. Y. Curb	1/16	1/16	⅛		
Bingham Mines	Boston	9⅛	9	9⅛	Sept. '19, Q	.25
Calumet & Ariz.	Boston	53½	51	51½	Sept. '20, Q	1.00
Calumet & Hecla	Boston	255	245	248	June '20, Q	5.00
Canada Copper	N. Y. Curb	*22	*20	*20		
Centennial	Boston	9	9	9	Dec. '18, SA	1.00
Cerro de Pasco	N. Y.	38⅜	34⅜	34⅛	Sept. '20, Q	1.00
Chief Consol	Boston Curb	3⅜	3⅛	3⅜	Nov. '20, Q	.10
Chile Copper	N. Y.	14⅛	12⅛	12⅜		
Chino	N. Y.	25⅛	21	21	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	*34	*33	*33½		
Con. Ariz.	N. Y. Curb	1/16	1/32	1/16	Dec. '18, Q	.05
Con. Copper M.	N. Y. Curb			*61		
Copper Range	Boston	33½	30	30½	Sept. '20, Q	.50
Crystal Copper	Boston Curb	*61	*50	*59		
Davis-Daly	Boston	7 1/16	6⅜	6¼	Mar. '20, Q	.25
East Butte	Boston	9⅜	9	9	Dec. '19, A	.50
First Nat'l	Boston Curb	*100	*80	*85	Feb. '19, SA	.15
Frankl'n	Boston	2⅜	2⅛	2⅛		
Gadsden Copper	N. Y. Curb			*70		
Granby Consol	N. Y.	26	20½	20½	May '19, Q	1.25
Greene Cananea	N. Y.	25⅜	23½	23½	Aug. '20, Q	.50
Hancock	Boston	3⅜	3⅛	3⅛		
Houghton	Boston Curb			*45		
Howe Sound	N. Y. Curb	3	2⅞		Oct. '20, Q	.05
Inspiration Con.	N. Y.	42	38	38⅜	Oct. '20, Q	1.00
Iron Cap	Boston Curb	8	8	8	Sept. '20, K	.25
Isle Royale	Boston	24	21	21	Sept. '19, SA	.50
Kennecott	N. Y.	22⅜	20⅜	20⅞	Sept. '20, Q	.50
Keweenaw	Boston			1⅛		
Lake Copper	Boston	2⅜	2⅛	2⅛		
La Salle	Boston	2⅜	2	2⅛		
Magma Chief	N. Y. Curb			*21		
Magma Copper	N. Y. Curb	26	24	24	Jan. '19, Q	.50
Majestic	Boston Curb	*14	*12	*12		
Mason Valley	Boston	1⅜	1⅛	1⅛		
Mass Consol	Boston	3⅛	1	3⅛	Nov. '17, Q	1.00
Mayflower-O.C.	Boston	4⅜	4	4		
Miami	N. Y.	19¼	17½	17⅜	Nov. '20, Q	.50
Michigan	Boston	3	3	3		
Mohawk	Boston	57½	51⅞	51⅞	Nov. '20, Q	1.00
Mother Lode (new)	N. Y. Curb	5⅛	5⅛	5⅛		
Nevada Con.	N. Y.	11⅛	10⅛	10⅜	Sept. '20, Q	.25
New Arcadian	Boston			2⅛		
New Baltic	Boston Curb			3		
New Cornelia	Boston	17⅛	16⅛	16⅛	Aug. '20,	.25
Nixon Nev.	N. Y. Curb	*5	*5	*5		
North Butte	Boston	15	10⅛	11⅛	Oct. '18, Q	.25
North Lake	Boston			*25		
Ohio Copper	N. Y. Curb			1/16		
Osceola	Boston	2⅛	2	2⅛		
Old Dominion	Boston	22⅜	21	21⅛	Dec. '18, Q	1.00
Osceola	Boston	31	27⅛	27⅛	June '20, Q	.50
Phelps Dodge	Open Mar.	†175	†150		Oct. '20, Q	2.50
Quincy	Boston	42⅛	41⅛	42	Sept. '20, Q	1.00
Ray Con.	N. Y.	13⅜	12⅛	12⅜	June '20, Q	.25
Ray Hercules	Boston Curb	*61	*61	*61		
St. Mary's M. L.	Boston	36	32	32	June '20, K	2.00
Seneca Copper	Boston	23	18⅛	18⅛		
Shannon	Boston	1⅛	1	1	Nov. '17, Q	.25
Shattuck Ariz.	N. Y.	7⅜	5	6⅛	Jan. '20 Q	.25
South Lake	Boston			2		
South Utah	Boston	*8	*8	*8		
Superior Copper	Boston	4⅛	4	4	Apr. '17,	1.00
Superior & Boston	Boston	2⅜	2⅛	2⅛		
Tenn. C. & C.	N. Y.	9⅜	8⅛	8⅞	May '18, I	1.00
Tuolumne	Boston	*50	*45	*45	May '13,	.10
United Verde Ex.	Boston Curb	*29	*27⅜	*27⅜	Nov. '20, Q	.50
Utah Consol	Boston	5	4⅛	4⅛	Sept. '18,	.25
Utah Copper	N. Y.	59	53	53⅛	Sept '20, Q	1.50
Utah M. & T.	Boston	1⅜	1	1 1/16	Dec. '17,	.30
Victoria	Boston			1⅞		
Winona	Boston	*50	*50	*50		
Wolverine	Boston	11	10⅛	10⅛	Jan. '20, Q	.50
LEAD						
Hecla Mining	N. Y. Curb	4⅛	4⅛	4⅛	Sept '20, QX	.15
St. Joseph Lead	N. Y.	14⅛	14	14	Sept '20, QX	.50
Stewart	Boston Curb			*13	Dec. '15,	.05
Utah Apex	Boston	3	2⅞	2⅞	Nov. '20, Q	.25
ZINC						
Am. Z. L. & S.	N. Y.	12	6⅛	8⅛	May '17,	1.00
Am. Z. L. & S. pf.	N. Y.	40	32	32	Nov. '20, Q	1.50
Butte C. & Z.	N. Y.	6⅛	5⅛	5⅜	June 18, I	.50
Butte & Superior	N. Y.	16⅛	10⅛	11⅛	Sept. '17,	1.25
Con. Interst. Cal.	N. Y.	7⅛	6⅛	6⅛	June '20, Q	.50
New Jersey Z.	N. Y. Curb	160	157	157	Nov '20, Q	4.00
Success	N. Y. Curb	4	2	2	July '16,	.03
Yellow Pine	Los Angeles	*85	*85	*85	June '20, Q	.03

Stock	Exch.	High	Low	Last	Last Div.	
GOLD						
Alaska Gold	N. Y.	1⅛	1⅛	1⅛		
Alaska Juneau	N. Y.	1⅝	1⅝	1⅝		
Carson Hill	N. Y. Curb			22½		
Cresson Consol. G.	N. Y. Curb	1⅛	1	1	June '20, Q	.10
Dome Ex.	Toronto	*50	*44	*46		
Dome Mines	N. Y.	12⅜	11⅞	11⅞	Oct. '20, Q	.25
Golden Cycle	Colo. Sprgs.	‡		*73	Sept. '20, Q	.02
Goldfield Con.	N. Y. Curb.	*9	*8	*9	Dec. '19,	.05
Hedley	Boston			4½	June '19,	.10
Hollinger Con.	Toronto	5.60	5.50	5 50	Nov. '20, X	.05
Homestake	N. Y.	48½	48	48½	Sept. '19,	.50
Kirkland Lake	Toronto	*	*	*43½		
Lake Shore	Toronto	†1.07	†1.02	1.08	Oct. '20, K	.02
McIntyre-Porcupine	Toronto	1.94	1.91	1.91	Sept. '20, K	.05
Porcupine Crown	Toronto	*23½	*22	*23	July '17,	.03
Portland	Colo. Sprgs.	‡		*60	Oct. '20, Q	.01½
Reorgan. Booth	N. Y. Curb.	*4½	*3	*3	May '19,	.05
Silver Pick	N. Y. Curb.	*6	*5½	*6		
Teck Hughes	Toronto	*7	*6½	*6½		
Tom Reed	Los Angeles	1.43	1.36	1.38	Dec. '19,	.02
United Eastern	N. Y. Curb.	2⅛	2⅛	2 1/16	Oct. '20, Q	.15
Vindicator Consol.	Colo. Sprgs.	‡		*18	Jan. '20, Q	.01
West Dome Consol.	Toronto	*5½	*5½	*5½		
White Caps Min.	N. Y. Curb.	*8	*6	*6½		
Yukon Gold	Boston Curb			1⅛	June '18,	.02½
SILVER						
Arizona Silver	Boston Curb	*21	*18	*20	Apr. '20, M	.03
Beaver Con.	Toronto	*38½	*35½	*35½	May '20, K	.03
Coniagas	Toronto	2.25	2.25	2.25	Nov. '20, Q	.12½
Crown Reserve	Toronto			*22	Jan. '17,	.05
Kerr Lake	Boston	3½	3⅛	3⅜	Oct. '20, K	.12½
La Rose	Toronto			*30	Apr. '18,	.02
McKinley-Dar.	Toronto	*50	*47	*48	Oct. '20, Q	.03
Mining Corp.	Toronto	1.68	1.60	1.65	Sept. '20, Q	.12½
Nipissing	N. Y. Curb.	8⅞	8⅛	8⅛	Oct. '20, QX	.50
Ontario Silver	N. Y.	4⅜	4⅛	4⅛	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb.				Jan. '12,	.10
Peterson Lake	Toronto	*11⅛	*11⅛	*11⅛	Jan. '17,	.01½
Temiskaming	Toronto	*32	*30½	*30½	Jan. '20, K	.04
Trethewey	Toronto	*26¼	*24¼	*24¼	Jan. '19,	.05
GOLD AND SILVER						
Atlanta	N. Y. Curb.	*1⅛	*1	*1		
Barnes-King	Butte	‡		1.11	Aug. '20, Q	.05
Bost. & Mont.	Boston			*63		
Cashboy	N. Y. Curb.	*8	*5⅛	*7		
El Salvador	N. Y. Curb.	1/16	1/32	1/16		
Jim Butler	N. Y. Curb.	*18	*17	*17	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb.	*6	*6	*6	June '16,	.05
Louisiana Con.	N. Y. Curb.	⅜	⅜	⅜		
MacNamara M.	N. Y. Curb.	1/16	1/32	½	May '10,	.02½
N.Y. Hond. Rosar	Open Mar.	†11	†9½		Oct. '20, QX	.50
Tonopah-Belmont	N. Y. Curb.	1 1/16	1⅛	1⅛	Oct. '20, Q	.05
Tonopah-Divide	N. Y. Curb.	1 1/16	1	1 1/16		
Tonopah Ex.	N. Y. Curb.	1⅛	1 1/16	1⅛	Oct. '20, Q	.05
Tonopah Mining	N. Y. Curb.	1⅜	1⅛	1 1/16	Oct. '20, SA	.05
West End Con.	N. Y. Curb.	1⅛	1⅛	1⅛	Dec. '19 SA	.05
SILVER-LEAD						
Caledonia	N. Y. Curb.	*18	*17	*17	July, '20, M	.01
Consol. M. & S.	Montreal	23	19⅛	21	Oct. '20, Q	.62½
Daly Mining	Salt Lake			2.40	July '20, Q	.10
Daly-West	Boston	4⅛	4⅛	4⅛	Oct. '20, Q	.25
Eagle & Blue Bell	Boston Curb	2⅛	2⅛	2⅛	Apr. '20, Q	.10
Electric Point	Spokane	*14½	*14	*14	May '20, SA	.03
Fed. M. & S.	N. Y.	9⅛	8	8	Jan. '09,	1.50
Fed. M. & S. pf.	N. Y.	31	28	30	Sept. '20, Q	1.75
Florence Silver	Spokane	*25	*25	*25	Apr. '19,	.01½
Grand Central	Salt Lake			*37½	June '20, K	.03
Iron Blossom	N. Y. Curb.	¼	¼	¼	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake			3.82½	Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	*11⅛	*9	*11		
Prince Consol.	N. Y. Curb	1/16	⅛	⅛	Nov. '17,	.02½
Rambler-Cariboo	Spokane	*8	*6	*8	Feb. '19,	.01
Rex Con.	N. Y. Curb	*6	*5	*5		
South Heela	Salt Lake	*74	*73	*73	Sept. '19, K	.15
Stand. S. L.	N. Y. Curb	1/16	1/32	1/16	Oct. '17,	.05
Tamarack-Custer	Spokane	2.20	2.00	2.00	Dec. '19, K	.03
Tintic Standard	Salt Lake	3.50	3.25	3.32½	June '20, Q	.10
Wilbert Mining	N. Y. Curb	*4	*4	*4	Nov. '17,	.01
NICKEL-COPPER						
Internat'l Nickel	N. Y.	17	15⅛	15⅜	Mar. '19,	.50
Internat'l Nick.pf	N. Y.	83	83	83	Nov. '20, Q	1.50
QUICKSILVER						
New Idria	Boston	2⅛	2⅛	2⅛	Jan. '19,	.25
TUNGSTEN						
Mojave Tungsten	Boston Curb	*9	*5	*9		
VANADIUM						
Vanadium Corp.	N. Y.	50⅞	45	47	Oct. '20, Q	1.50
ASBESTOS						
Asbestos Corp.	Montreal	92½	84	88	Oct '20, Q	1.50
Asbestos Corp. pf	Montreal	98	94	98	Oct. '20, Q	1.75
MINING, SMELTING AND REFINING						
Am. S. & R.	N. Y.	57⅛	51⅛	53	Sept '20, Q	1.00
Am. S. & R.pf.	N. Y.	91	88⅛	88⅛	Sept. '20, Q	1.75
Am. Sm. pf.A.	N. Y.	78	76⅛	75⅛	Oct. '20, Q	1.50
U. S. Sm. R. & M.	N. Y.	57⅛	48	48	Oct. '20, Q	1.50
U.S.S.R.& M pf.	Boston	44⅛	43⅛	43⅛	Oct. '20, Q	.87½

*Cents per share. †Bid or asked. ‡Quotations missing Q, Quarterly.
SA, Semi-annually. BM, bimonthly. K, Irregular. I. Initial X, includes extra